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Bios

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Abstract

Chapter I introduces the topic of international agricultural research. This chapter presents this subject as a basis for examining the relations that have emerged between science and politics in the twentieth century. A deliberate effort has been made to pose general questions that are derived from literature analyzing the sociology and philosophy of knowledge.

In Chapter II selected professional societies in twentieth century America are reviewed in terms of incipient relations between scientific inquiry and social interests. The Rockefeller Foundation is identified as a major influence in biological and agricultural research. The Foundation's work is reviewed with respect to the type of investigations it encouraged both within professions and among public institutions.

Chapter III directs the reader's attention to a specific mission initiated by the Rockefeller Foundation in Mexico during the 1940s. In this mission are the origins of the contemporary network of international agricultural research centers. This chapter describes the conflicts that first emerged within the Rockefeller Foundation regarding the ways in which problems were identified, alternatives weighed, and solutions proposed by 'scientists.'

During the 1950s the Rockefeller Foundation's community of agricultural scientists transformed production practices, organized research institutes, and reshaped the meaning of agriculture in Mexico. In Chapter IV these changes are evaluated in light of controversies between U.S. agricultural scientists on one side and Mexican agricultural scientists

and political leaders on another side. Much of the discussion centers on the nexus of political and scientific concerns within the scientific community.

Chapter V considers the extent to which U.S. agricultural scientists reproduced their mission within Mexican professional communities. The reader discovers that the objectives of improving agriculture incorporated not just production criteria--the mission also created a corps of indigenous professionals and institutions patterned after a model fostered by the Rockefeller Foundation. This chapter looks at the characteristics of institutions and scientific communities fostered by the Foundation's mission in Mexican agriculture.

In Chapter VI our attention turns toward the Foundation's work in Mexican agriculture and its relationship to social development. During the 1950s initial attempts were made by natural scientists to integrate their work with that of social scientists. This epoch provides a background for the eventual resolution of conflicts within the scientific community at CIMMYT.

During the early 1960s the Foundation's mission in Mexican agriculture was brought to a close and measures were taken to capitalize on the experience and to establish a network of international agricultural research centers. Chapter VII investigates a specific rural development project, Plan Puebla, that accompanied the creation of the International Maize and Wheat Improvement Center. Certain themes introduced in Chapter VI extend to this period, when tensions grew and eroded community consensus surrounding the production and use of scientific research.

Chapter VIII describes the widening debate between scientists' claims of achievements and critics' observations in the field. Particular attention is directed toward the uncertain relationships that arise between natural and social scientists at CIMMYT. The manner in which these disputes were resolved illustrates the nature of relationships that operate between scientists and non-scientists.

Chapter IX concludes with a reexamination of questions raised in Chapter I. Its purpose is to consider the evolution of international agricultural research at the International Maize and Wheat Improvement Center and the relations that have emerged between science and society.

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It is quite simply not the case that I possess sole responsibility for this work. The contributors to this work are many and their combined influence extends to sharing in both the merits and demerits of this book.

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There are necessarily various of individuals whose contributions must remain anonymous in this type of research. At both the International Maize and Wheat Improvement Center and the Consultative Group on International Agricultural Research various persons generously recounted a history which, heretofore, remained not simply unrecorded, but largely unspoken. Their candor and reflections, especially staff members at CIMMYT, represented an invaluable source of information.

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Introduction

This book is a critical study of science that examines the origins and development of international agricultural research.

Scientists participating in the founding of the international agricultural research centers have identified various factors influencing the context of international agricultural research. The 'factors' are neither simply within our understanding of a formal body of scientific knowledge, nor are these elements adequately defined as an amorphous collection of social conditions. The written accounts provided by scientists participating in founding the network of international agricultural centers describe very specific events, institutions, and relationships as guiding their work. Common to these accounts are the unique political and economic interests that have operated on the communities of scientists working at the international agricultural research centers.

This study focuses on the original international agricultural research center begun by the Rockefeller Foundation in Mexico during the 1940s--the International Maize and Wheat Improvement Center, or CIMMYT as it is known by the Spanish acronym. This history of international agricultural research is based on a concern that transcends particular individuals and institutions.

A significant 'finding' emerging from this examination of international agricultural research concerns the use of science as a vehicle for politics. The fact that this conclusion does not follow from a strictly empirical or positivistic investigation is part of the argument contained in

this text: the same methods historically employed for gaining scientific knowledge are not appropriate for understanding the effects of science on society.

One purpose of this work is to place our understanding of science within a historic context. Present day accounts of science frequently describe the sequence of how particular facts have become assembled into a body of thought. Absent from these accounts, particularly texts introducing neophytes to the biological sciences, is any sense of how certain, and not other, facts have been assembled into a particular body of knowledge. The relationships between bodies of knowledge and their historic context represents a critical, yet little analyzed factor in the natural sciences. This investigation includes: (1) an analysis of the nature of professional scientific communities fostered by U.S. corporate capital at the turn of the century; (2) an assessment of the social consequences and political struggles that resulted from the reorganization of Mexican agriculture directed by U.S. scientists; and (3) a consideration of the evolution of international agricultural research in the context of relationships forged between political institutions, social classes, and scientific communities. A common theme explored in each of the following chapters is whether or not we have learned to pose the questions appropriate for understanding the social and political dimensions of science.

Foundations of Science: A Study of International Agricultural Research

How can we begin to understand the relationships that have emerged in the twentieth century between science and politics? And how can we understand one without examining the other? The relationship between science and society generally appears to people as a one-way street: science is treated as a force which may be acted on by society, but does not act upon society.

In spite of the promise of a science-based utopia, the authority exercised by communities of scientists has proven insufficient to eliminate hunger, illness, and other conditions opposed to life. While observers are divided as to why these problems do not get solved, their continued presence is nevertheless used by various institutions and their leaders to extend certain kinds of science for organizing both state and society. The kinds of science that have emerged and the reasons for their emergence explain the nature of relations between science, society, and politics. One of the best illustrations of this situation is the rise of agricultural science to a position of political authority on a global scale.

During the last fifty years agricultural practices have been fundamentally altered in Asia, Africa, and Latin America. No longer do traditional cultivation and harvesting methods dominate the production of basic food crops. The cultivation of traditional staples by peasant households, on small plots forming the basis of village livelihood, has been replaced by large agricultural holdings that use capital-intensive technologies to produce commodities for purchase by wage earners throughout the world.

A fundamental source of change in agricultural practices has been the rise and spread of scientific research. The dissemination of agricultural research on a global scale has been predicated by the rise of international research centers and their corresponding professionals. Since the 1940s agricultural scientists have risen to positions of authority throughout the world. Investigations by plant pathologists, geneticists, and scientists from associated disciplines at Liebig, Germany in the 1700s, Ithaca, New York in the 1800s, and Chapingo, Mexico in the 1900s share a common search for technical improvements in agricultural production. Global changes in the biological sciences are being tested in university laboratories, experiment stations, and farmers' fields.

A contemporary account of global agricultural change is contained in a report issued by the lead institution for the system of international agricultural research centers, the Consultative Group on International Agricultural Research (CGIAR). In its 1983 report, the CGIAR describes the operation of a 'network' of global institutions to foster the application of science-based agricultural techniques [1]. The mandate of the international agricultural centers is to provide research in order to provide sufficient food to feed the world's hungry populations.

The CGIAR heads a system of thirteen international agricultural research centers. The older international centers focus their attention on one or more basic food crops such as root crops, cereals, pulses, or forage plants. The international centers emphasize research on plant relationships and the improvement of the quantity or quality of food in the world. The agricultural scientists have created improved genetic materials and plant varieties, as well as planting, harvesting, and storing recommendations practiced on tens of millions of acres throughout the world.

The international centers are the locus of numerous local, national, and international institutions. Various national programs, for example, conduct experiments comparing different plant types for various characteristics. The International Food Policy Research Institute and the International Service for National Agricultural Research, two recent additions to the international network, also provide training to national agricultural policy-makers.

In 1971 three United Nations organizations--the World Bank, the Food & Agriculture Organization, and the Development Program--founded the Consultative Group on International Agricultural Research. By 1983 the CGIAR members included more than twenty countries, nearly a dozen international organizations, and several major foundations. Contributions had grown from 20 million dollars in 1972 to more than 170 million dollars in 1983.

In 1983 the CGIAR described their history as a gradual 'networking' of scientific institutions. The network of international centers, according to the CGIAR, is based on the increasing need to apply science to agriculture. The network is portrayed as a wheel with older international centers located at the hub of the wheel and younger national programs operating at the periphery. The organization of the international centers allegedly implies no hierarchy; national agricultural programs may accept or reject the science-based counsel of the international centers [2].

The authority of the international centers is premised on their scientific foundations. This authority is generally understood to reflect a movement toward more universal ends. Whereas early colonial research stations focused attention on cash crops, leaders of the international agricultural research centers conceive their mission as directed at the problem of hunger. The international agricultural research centers, in spite of fostering global changes in agricultural production, continue to confront age-old problems. Hunger, malnutrition, and diseases worsened by the lack of sufficient foods still immiserate millions of people worldwide. Additional social problems of inadequate housing, expensive land rents, insufficient employment, and especially low household standards of living continue to plague the world's populations.

The architects of international agricultural research have long presented their efforts to supply adequate food as only one small part of the economic development problem. Numerous journal articles, books, university seminars, national conferences, and international agencies have focused on the question of how to better deliver the benefits of agricultural research. Common to investigations of agriculture, however, is a failure to consider how problems in agriculture begin. Is the hunger problem best understood as a problem rooted in the inability to produce sufficient quantities of food? Or does the problem of hunger as defined by

insufficient production, subvert our understanding of more fundamental causes of hunger and underdevelopment?

For many years, observers in both developed and underdeveloped countries have attacked technical assistance programs as insufficient to solve the problems of underdevelopment. Scholars representing various schools of thought (e.g., dependencia) argue that the question of power is central to understanding international development. Yet the practice of international agricultural development continues to be dominated by technical discussions. The critics of development programs, including technical assistance in agriculture, insist that the fundamental problems are political.

The weakness of observers who note the primary role of politics in international development programs, however, is the lack of an adequate analysis of the 'technical' aspects of assistance. Development experts contend that while technical assistance may not be sufficient for development, science-based programs are a necessary part of any national development program. Science appears to be a neutral and necessary part of development. Looking beyond the assumptions and appearances, what is the relationship between politics and science in technical assistance programs such as international agricultural research?

Central to the idiom of agricultural research scientists are expressions that identify relationships between physical entities, such as plants and soils. Such terms as 'scale neutral' are employed by scientists to identify science-based agricultural practices which in and of themselves serve no particular social interest. Scientists contend that questions about who owns the land, which members of a community receive water, or the pricing of land rents are external to their description of problems in agriculture. Leaders of international agricultural research centers point to the basic science texts in plant pathology or genetics as demonstrating the absence of political considerations. The international centers, they argue, cannot and do not offer a solution to all problems in agriculture--their mission is to assist in the production of basic food crops.

While sufficient food has been cultivated in certain regions adopting modern techniques, various problems in agriculture continue in the 1980s much the same or worse than they appeared in the 1900s. The commonly perceived solution to such problems as malnutrition is the need to further extend the fruits of scientific research to a larger

number of people. For all of the technical advances spawned by international centers, from plant breeding to pest management, various social problems continue to persist amidst a technologically advancing agriculture.

Or is it possible that the persistence of social problems in agriculture are linked to the practice of agricultural research?

Scientists at the international agricultural research centers practice a science based on the accumulation of facts. Knowledge is constructed according to methods that test and verify the validity of various claims. A typical test at the international centers, for example, concerns whether a particular plant possesses characteristics which produce more food than another plant. Such an experiment, viewed in isolation, appears to contain no political agenda. Either a plant does or does not produce more grain, for example, than another plant. But what about the situation where no other experiment is conducted? The discussion and analysis of a single formulation of 'the problem' does not necessarily provide an adequate response to other definitions of the problem. Central to the research performed by scientists at the international centers is a question about what problem they are working to solve.

Excluding competing theories about the cause and persistence of problems in agriculture represents a fundamental political dimension of both the biological sciences generally and international agricultural research specifically. In place of the comprehensive accumulation of facts by scientists worldwide, a dialectical situation may exist in which certain kinds of knowledge are suppressed. The authority of biological sciences within international agricultural research centers is now sufficiently entrenched that appeals to consider other problem-solving approaches appear to require approval by the dominant community of scientists.

The definition of problems represents another political dimension of international agricultural research. The boundaries of the biological sciences limit the field of legitimate and illegitimate problem-solving approaches. During the twentieth century biological scientists, for example, generally have reduced the scope of problems to interactions between micro-biological entities. The domination of this perspective by institutions concerned with science has discounted an examination of the social, political, and economic relations as linked to problems in agriculture.

To understand the practice of science at the international centers, something more is needed than the examination of 'facts.' Comprehending the practice of science requires an examination of how problems are defined, the process of assembling knowledge, and the reviewing of consequences.

If the mandate of the international agricultural research centers is to produce additional and more nutritious foods, what efforts are taken by scientists to understand whether these benefits are ever realized by intended beneficiaries?

The result of technical changes in agriculture is increased production. But is the primary objective of bringing science to agriculture simply a concern with increasing production? Have scientists at international agricultural research centers fashioned sophisticated tools that cannot address fundamental problems in agriculture? To what extent does a focus on technological aspects agriculture further obscure the recognition of fundamental problems?

The answer to these questions cannot be found by examining factors internal to the practice of science. Instead one must examine the social history of agricultural research. Examining the foundations of international agricultural research is the major purpose of this work.

How did the international centers evolve prior to the formal initiation of the Consultative Group in 1971? One of the most authoritative accounts of the early history of the international centers is contained in a book written by three scientists who helped to establish the earliest mission of technical cooperation in agriculture. Campaigns Against Hunger by Paul Mangelsdorf, E.C. Stakman, and Richard Bradfield describes the establishment, in 1941, of a technical agricultural mission, the Mexican Agricultural Program [3]. In explaining their impressions and perspectives on Mexican agriculture, the three scientists emphasize the absence of basic research and the benefits of replicating the experience of U.S. agricultural practices, particularly the role of science-based institutions such as agricultural experiment stations.

From the 1940s to the 1960s the Mexican Agricultural Program modernized important segments of Mexico's agricultural production. Mexico's system of agricultural experiment stations, agricultural colleges, and their federal institutions was significantly influenced by the technical agricul-

tural mission established by U.S. agricultural scientists. By the early 1960s Mexican agricultural production of basic food crops had achieved impressive increases in yield per hectare in many agricultural regions.

Perhaps of greater importance was the expansion of this success to other areas of the world. During the 1960s four international agricultural research centers were established in Latin America, Asia, and Africa. In 1966 the Mexican Agricultural Program was transformed into the International Maize and Wheat Improvement Center. In many vital respects, the Mexican Agricultural Program served as the foundation on which the network of international agricultural research has been constructed since the 1970s. Indeed, the history of the Mexican Agricultural Program represents a central chapter in global transformation of agricultural practices during the twentieth century.

The history presented in this account, however, contains significant differences from that contained in Campaigns Against Hunger. Whereas the authors of Campaigns describe scientific goals, this account reveals the use of science to achieve political ends. As part of the arguments contained in this text, heavy reliance has been placed on the accounts of participants--those scientists and researchers who worked with the Mexican Agricultural Program (1941-1960) and the International Maize and Wheat Improvement Center (1963-present). The history of international agricultural research presented here is based on the comprehensive review of hundreds of documents authored by the scientists who participated in founding the first international agricultural research mission. Much of the record contained in this history of international agricultural research has never before been presented in other published works. What factors account for the existence of certain kinds of scientific commitments, but not others? What relationships between scientific authority and political power have been fostered by the international agricultural research centers? What are the possibilities for international agricultural research to fulfill its mandate--promoting the welfare of mankind? These are some of the central questions that have guided this research.

CHAPTER I--NOTES

1. "The Consultative Group and the International Agricultural Research It Supports", Consultative Group on International Agricultural Research (Washington, D.C., CGIAR Secretariat, September 1983).
2. Ibid, pp. 1-10.
3. Elvin Charles Stakman, Richard Bradfield, Paul Mangelsdorf, Campaigns Against Hunger, Belknap Press, Cambridge, Mass., 1967, 328 pages.

2

The Rockefeller Foundation and the Management of Science

The origins and development of international agricultural research begins with its link to the social context. Professionals have treated this history as an accounting of research projects. Another method, following from the discussion of Chapter I, has analyzed not simply the data but the process by which certain kinds of knowledge became pertinent to projects in the global research network.

Several authors identify the turn of the twentieth century in the United States as an appropriate place to examine the ties between science and society. The growth of state bureaucracies is described as a characteristic part of political liberalism in the United States during this period. It is also at this time that observer Jeffrey Lustig cites the rise of science-based professions as serving political ends:

Scientists would constitute a neutral bar before whom people of differing outlooks could bring their conflicts, and by whose verdicts they would willingly be bound. Professionals armed with scientific method would thus make it possible to dispense with the conflict and uncertainty that had always characterized the political realm.[1]

The objectivity supposedly inherent in these judgments, according to Lustig, was frequently revealed as an efficient disguise for corporate control.

According to another observer, James Weinstein, one of the major accomplishments of the Progressive period was that corporations kept issues in which they held an interest outside of politics. Central to this process was the creation

of 'experts' whose work appeared as technical and detached from social interests. Weinstein states as an example that one of the major corporate organizations during the 1920s and 1930s, the National Civic Federation, promoted a system of education ostensibly "to protect the nation against destruction from forces operating within [the country]." [2] Systems of national education were, according to his perspective, channeled public dissatisfaction with the unequal distribution of power and privilege away from structural and toward individual responsibility.

Another work complementing Lustig and Weinstein's is David Noble's examination of the engineering professions in twentieth century America. Noble identifies the emergence of centers for professional training as a "class-bound phenomenon." [3] The promotion of engineers to positions of authority, Noble states, not only served the accumulation of capital, but advanced corporate interests marching under the "banner of science" within government bureaucracies.

Magalli S. Larson, writing more generally, argues that the rise of professionalism under the tutelage of corporate capital has become a means for monopolizing political choice. First, the professionalization of knowledge expropriates discussions from the political arena. Second, the relatively greater power exercised by the ruling class enables competency to become constructed according to these interests. [4]

In Lustig, Weinstein, Noble, and Larson the relationship between scientific communities and the knowledge produced is understood as mediated by powerful political forces. Their analyses indicate that relations between specific fields of scientific inquiry and society can be largely understood as the product of corporate capital. Thus a second area for initiating this study of international agricultural research is in the historic relationship between specific social interests and professionals associated with international agricultural research.

The Rockefeller Foundation: Experiments in the Management of Science

The Rockefeller Foundation's participation in international agricultural research spans many decades. For some observers this association dates back to the formal network of international centers created in 1971. Others note that

the Foundation participated in sponsoring several international centers as early as 1960. And accounts identifying the Rockefeller Foundation's co-sponsorship of a technical assistance mission with the Mexican Government begin in 1943. Each of these accounts reflect a period in which the Foundation, along with other agencies, influenced the course of international agricultural research. Yet it is possible to trace the Rockefeller Foundation's relationship to projects in international agricultural research still further back.

The philanthropic organizations generated from the fortunes of John D. Rockefeller have, since 1901 with the creation of the Rockefeller Institute, exercised control over the genesis and maturation of various science-based professions. These activities have significance for the study of international agricultural research in two specific ways. First, the Foundation organized a number of demonstrations, especially through its General Education Board in the southern United States, providing experience in the design of agricultural research. Second, the Foundation also profited from organizing technical assistance missions internationally in the 1910s, 1920s, and 1930s. Each of these endeavors contributed to the Rockefeller Foundation's later role in international agricultural research.

More generally, the history of the Rockefeller Foundation's role in the promotion of scientific inquiry suggests an influence similar to the notions advanced by Lustig et al., i.e., the manipulation of professional communities toward the production of specific kinds of knowledge. This history suggests, however, an influence that is more subtle and in certain respects distinct from a conspiratorial model based on corporate greed. Instead, there appears a more rationally grounded logic, in which science is managed towards objectives believed to benefit all social classes. Our purpose here, therefore, is to assume neither perspective, but consider the nature of influence exercised by the Rockefeller Foundation in the management of science.

Certain authors, such as Harry Cleaver, have examined the role of the Rockefeller Foundation in the management of science with respect to a well-defined social interest. [5] The Foundation's interest, according to Cleaver, appeared defined around aspects of accumulating capital and fostering conditions propitious for U.S. investments abroad. A major difficulty in Cleaver's analysis is how the Foundation's

interests are related to professional communities and scientific research. Although Cleaver employs the term 'ideology' to explain this relationship between science and politics, the details remain nevertheless elusive.

One of the qualities that distinguished the Rockefeller Foundation's relationship to science from other institutions based on corporate capital (e.g., corporate laboratories, college curriculum, etc.) came from an interest in guiding the production of knowledge. This interest in knowledge and not simply products, frustrated propositions that their work was simply self-interested or that it gained materially from advances in science. How could the Foundation manipulate science according to its particular interests without destroying those qualities that made it science? Wasn't the Foundation seriously limited by the degree to which it constructed science based on capitalism? These questions beg a reconsideration of how the Rockefeller Foundation, as analyzed by Cleaver, influences science.

A means for analyzing the Foundation's role vis-a-vis science is with respect to its sociological dimensions. This method analyzes the ways in which the Foundation's scientific communities differed from others. In the early 1900s, for example, there existed numerous schools of medical thought. The Rockefeller philanthropy, in one of its first campaigns helped to consolidate medical science. How did this consolidated notion of medicine differ from other approaches and what influence did the Foundation's managers of science exert in settling these disputes?

The basis for divisions between medical sects did not result from disagreements about the existence of certain phenomena, for example micro-organisms or chemical properties. Rather, their differences frequently emerged from perceiving different relationships between levels of observation. Many of these disputes centered on relationships between chemical events and social ones. This provided a basis for political controversy in which the role of expertise was contested by groups claiming professional authority. How could professional authority in such circumstances be expected to resolve these differences?

Take, for example, the subject of public health in the United States. Among the earliest public health studies conducted, for New York City in the mid-1800s, were those authored by John H. Griscom. Griscom's background included many years of study in biology. He also placed value on the

elimination of specific contagions as an important basis for improved health. Griscom's study also pointed to the importance of other elements as affecting the public's health.[6]

The fact that only certain classes experienced the major part of suffering from particular diseases troubled Griscom. Why did a disease, that was supposedly caused by a specific germ, manifest itself mainly among lower economic classes? Griscom contended that living conditions, as much as germs, in New York's slums contributed to the poor health among the less wealthy. His report suggested that along with sanitation practices, improved health depended on changing social conditions as well. He mentioned reducing rents and upgrading conditions of work as factors integral for the advance of good health. There is, however, no evidence that Griscom's recommendations ever gained serious attention. One of the City's first public health programs was based, instead, on a program initiated by the Rockefeller Institute for Medical Research.

In the same year as its inception, 1901, the Rockefeller Institute for Medical Research (hereafter referred to as the Institute) started a program of cooperative work with New York City's health department. The joint program studied the conditions of milk supply, its sale and storage as a means for disease control. Researchers suspected a relationship between this major food source and the spread of a specific contagion (i.e., tuberculosis). By 1902 their suspicion was confirmed by surveys that examined the travel of milk from production locations to those of consumption. The major recommendation identified the storage of milk by consumers as crucial in the control of bacteria.[7]

While the study included certain elements concerned with social conditions, such as tenement housing, its recommendations directed attention at two factors: individual habits and disease control. Researchers used the fact that children often were among those most seriously affected by tuberculosis to argue that mothers assume responsibility for ensuring milk's quality and control disease. By 1902 the Institute's prescriptions received wide reporting in New York City's newspapers.[8] The public was subjected to explicit guidance designed by the Institute's professionals to achieve public health. At the same time, this event marked the Institute's first success at shaping public policy and reshaping social practice.

In 1902 the director of the Institute, Abraham Flexner, following the advice of a consultant to the Institute, Theobald Smith, expanded research on infectious diseases.[9] Smith helped organize the Institute so that researchers had "perfect freedom" to pursue any facet of the disease problem they chose to investigate. In subsequent decades the Institute's scientists made important contributions to public health, reducing deaths and suffering from such diseases as cerebro-spinal meningitis, syphilis, and infantile paralysis.[10]

At the same time that the Institute produced these laudable ends, it also promoted changes of a more questionable nature. Under the aegis of the Institute's leadership there also occurred a consolidation with respect to the diversity of medical sects and perception. While differences remained among various persons claiming to represent the science of medicine, those associated with the Institute organized to promote but a single conception as the basis for medical and public health practice. As their authority expanded that of others disappeared. Differences, moreover, were resolved not by informed discussion, experimentation, or the like. Conceptions such as those advanced by John Griscom were quite simply excluded from public and professional institutions over which the Institute exerted increasing control.

One of the architects in this professional consolidation was Frederick T. Gates. Gates served as one of John D. Rockefeller's most trusted employees.[11] His position arose from Rockefeller's interest in organizing a philanthropic foundation, the contributions of which would make lasting contributions for the betterment of mankind. The programs which emerged from this philanthropy over the next several decades were mixed blessings.

As an advisor whose work demanded a familiarity with medicine, Gates reviewed various literature in search of a model which the Institute could support. He soon found this in a text authored by William Osler in Principles and Practice of Medicine. [12] Gates found in Osler's work a notion of medicine that suited his purposes for consolidating medical practice. Osler advanced a conception of medicine that relied especially on the location of disease in terms of germ theory and laboratory research.

Gates' promotion of germ theory occurred not in combination with other approaches to the study of medicine, but

as the singular basis for scientific practice and social policy.[13] One of the fundamental consequences for a discourse limited to germ theory was the reduction of perception regarding other, especially social, phenomena. Precisely the integration between social and biological observations that allowed Griscom to argue for changes in working and living conditions, were now obliterated according to the conceptions advanced by Gates and associates.

In 1908 Abraham Flexner of the Rockefeller Institute joined with Dr. Pritchett of the Carnegie Foundation to conduct a study of medical education in the United States.[14] Flexner first traveled to Chicago to discuss his study with leaders of the American Medical Association, including the council chairman, Arthur Dean Bevan. Flexner next went to Johns Hopkins University to better acquaint himself with medical researchers who patterned their investigations after Osler's approach to medicine. In the following months, Flexner visited 155 medical schools in the United States and Canada.[15] Before distributing his report, Pritchett wrote Bevan anticipating its consequences for professional practice: "When our report comes out, it is going to be ammunition in your hands." [16] The ammunition referred to a goal shared by Pritchett and Bevan to empower professional authority according to that model employed by the Institute.

Flexner reported that there were too many doctors of too poor a quality. The remedy, according to Flexner, involved producing fewer doctors of higher quality. The determination of quality, however, rested with those researchers allied with particular institutions (e.g., American Medical Association, Johns Hopkins, Rockefeller Institute, and so on). Flexner's report contributed not only to the increased status of particular schools, but the elimination of competing notions of medicine.

During the next twenty years the "Rockefeller medicine men" propelled their notions of medicine into the forefront of the profession. Through grants of millions of dollars to medical schools, the encouragement of organizations like the American Medical Association, the promotion of particular standards within state and federal bureaucracies, and other demonstrations medical practice grew more specialized and restrictive. While centers of 'deviant' medical education gradually ceased functioning, remaining professionals learned to refashion themselves according to dominant modes of thought or face the loss of professional status.

At the same time the Rockefeller Institute expanded its activities, elaborating its work in medicine with respect to other disciplines. The Board of Directors for the Institute actively encouraged researchers to initiate inter-disciplinary investigations. Within its first several decades Institute researchers responded with projects that integrated studies in epidemiology and statistics, cytology and pathology, experimental physiology and zoology, and fields heretofore treated as separate.[17]

One chronicler of the Institute's history explained innovative research as linked to a broader mission shared by the Institute's scientists: "The Institute's definition of the key words in its title, 'Medical Research,' was henceforth to include any kind of investigation that might contribute to the understanding of health and disease, no matter how widely it ranged from the body of a suffering man to subatomic particles." [18] This did not mean, however, that researchers' investigations could pursue any and all courses. In practice, the Institute fostered a climate favoring only certain research orientations. This occurred most importantly at the level of those allowed to participate within the Institute itself.

The Institute's Board of Scientific Directors pursued a policy of recruiting a community of like-minded scientists from which they derived authority. Individual scientists, and particularly those more renowned members of the Institute, instead of representing some unique quality, reflected a common ethos shared with others. One of the early researchers recruited by the Institute's heads, for example, was Jacques Loeb. Loeb gained wider professional recognition soon after he joined the Institute with the publication of his major work, The Mechanistic Conception of Life (1912). In this work, Loeb advanced a notion of health based on the metaphor of the machine. He referred to improvements in health as fashioned after an engineering project: "In a very general sense the fats, carbohydrates, and proteins provide the substance and form with which it [the body] operates." [19]

Loeb's work reflected an orientation which characterized the entire research community at the Institute. Flexner, like Loeb, had also conceived of medicine in mechanistic terms: "A living organism could be regarded as a machine which might be taken apart and reassembled if its structure and functions were fully understood." [20] These commonalities existed, moreover, not simply at the level of discursive

practice. These linguistic forms also reflected a perceptual approach to medical research. The Institute's investigators largely limited their observations to a range that extended from the individual's body to more minute processes within it. For Flexner, Loeb, and other Institute members this approach constituted the legitimate boundaries of medical research.

In one respect the Institute's orientation provided a basis for various medical breakthroughs particularly in the field of disease control. But its work also obscured opportunities for achieving health. Many of these opportunities depended on a more critical examination of the context in which bodies worked. A language and perception which conceived of life in mechanistic terms did not address various health-related matters. These other matters might be expressed in a single question: "What is the purpose of production?"

The difference between research pursued at the Institute and that conducted by others reflected the social significance of these pursuits. A contemporary of Loeb's, Dr. Caroline Hedger, provided a much different perspective of the mechanistic aspects of life. In a paper presented before the American Academy of Medicine, Hedger addressed the subject of infant mortality. Hedger marshalled evidence showing that large numbers of women had poor health which was not adequately explained by germ theory. Nor, she argued, were those measures aimed at proper sanitation or personal hygiene sufficient to improve the health of many infants. Hedger directed attention at the need to analyze infants' health from the perspective of mothers' working conditions. She suggested an epidemiology based on job classifications: "Beasts of Burden trades, Physical Strain trades, Nervous Strain trades, and Poisonous trades." [21]

The Institute's research community assigned no value to the kind of investigations proposed by Griscom, Hedger or their kind. This did not eventuate from a rejection of their work as individuals; rather, their work was dismissed as soon as it demanded observations of the social context. The standards of professional practice that Flexner, Gates and others orchestrated at the Institute circumvented a consideration regarding the social dimensions of health. Flexner acknowledged the importance of the Board of Scientific Directors for setting research parameters: "the influence of the board of trustees . . . determines in the social and

economic realms an atmosphere of timidity which is not without effect on critical appointments and promotions.[22] But around what did Flexner, Gates and others base the Institute's work?

Certain of the Institute's energies were aimed at solving problems which had economic value. One of the larger projects of the Institute, for example, derived from petitions filed by groups with important commercial interests:

In 1913 a calamity a thousand miles away placed a problem of animal disease squarely before the Board of Scientific Directors of the Rockefeller Institute. An outbreak of hog cholera sweeping the Western states had caused a loss estimated at thirty to fifty million dollars, impoverishing many farmers and seriously affecting rural trade. James J. Hill, the powerful president of the Great Northern Railway, deeply concerned about the welfare of farmers in its territory and the business they produced, offered the Institute \$25,000 for an investigation in hog cholera.[23]

By 1914 Abraham Flexner and Theobald Smith proposed a full-scale department of animal pathology. Hill's interests generated an additional commitment of one million dollars from John D. Rockefeller, Sr. for further studies in animal science at the Institute.[24]

The pursuit of research originating in commercial interests occurred on other occasions at the Institute. By the 1930s the Rockefeller Institute worked on projects initiated by, or in cooperation with, personnel representing various industrial laboratories, including those of Shell Oil Company, Eli Lilly & Company, Ciba Chemical, American Cyanamid, the Squibb Institute, Lever Brothers Company, the Merck Institute, and the Upjohn Company.[25] Yet, the totality of the Institute's work cannot be adequately understood as based on projects conceived by corporate capital. While the Institute continued to make important contributions in this regard, its major work remained the production of scientific knowledge. Its particular value derived by fostering new modes of social control.

The Institute offered a means for interpreting social phenomena (e.g., occupational disease) and organizing social action (e.g., public responsibilities for health) while suppressing more radical solutions (those present in investigations conducted by Griscom, Hedger and others). As the

Institute matured, its leadership remained active in controlling the boundaries of professional research and discussion. These experiences provided some of the first indications regarding the value attached to the management of science. The pattern of this management reappeared in later decades with the founding of international research.

Studies in Food and Health

Among those investigators who received support from the Rockefeller Institute and the School of Public Health at Johns Hopkins was Dr. E.V. McCollum. McCollum received his early training at the Sheffield Scientific School of Yale University. In addition to studies in physiological chemistry, McCollum also worked with Thomas Osborne at the Connecticut Agricultural Experiment Station. Osborne's work in protein chemistry and plant proteins earned him recognition as one of the first leading authorities in genetic research. McCollum's studies with Osborne led to similar investigations at the University of Wisconsin in 1907.[26]

As a professor with time for research, McCollum focused on the relationship between chemical content in foods and animal growth. This work, commonplace in current investigations, broke with that of his contemporaries whose work focused on the metabolism of farm animals, "a seeming necessity because of the need to insure farm support in state legislatures." [27] Paralleling McCollum's work at Wisconsin and Osborne's at New Haven, were additional studies undertaken at the Carnegie Institute of Washington. By 1912 McCollum, Osborne, and L.B. Mendel found in their research the role of fat soluble substances for carrying on normal life processes.[28]

McCollum gained further recognition for the breakthrough that led to the discovery of vitamins A and D. The importance of this discovery did not go without notice by either Wisconsin's milk industry or other scientists. The dairy industry later credited McCollum and his co-workers with establishing milk as "the most effective food for making good what other common foods lacked." [29]

The value of foods that provided a basis for adequate nutrition also gained the attention of scientists at the Johns Hopkins School of Public Health. Within a decade McCollum joined the others at Hopkins to explore new areas and relationships between food and health. While he continued much of his earlier work, McCollum now also struck off

on his own to explore various properties in food that had bearing on health. He now used his 'freedom' as a researcher to promote novel investigations regarding the role of nutrients and physical development.

By the close of 1922 McCollum had submitted a proposal for consideration before the international Health Board of the Rockefeller Foundation. In a meeting attended by Wickliffe Rose, John Ferrell, Victor Heiser, and several others the proposal received scant review. The basics of the proposal involved diet and its influence on the spread or contraction of infection. Although initial support had been granted by the Milbank Fund, Dr. Heiser reported "they have run into a snag of determining upon a practical field test." [30]

As discussion followed regarding the difficulties of a practical test, the suggestion arose for looking to historic cases. The International Health Division, Rockefeller Foundation (IHD) staff discussed the possibility for looking at Holland during World War I as an example of differences in diet having affected the increase of tuberculosis. Rose, however, objected to the proposal: "... it would seem to be a complex problem," he complained, "it would be difficult to get definite conclusions." The staff supported Rose's objections and tabled for further consideration McCollum's proposal. [31]

The decision to take McCollum's proposal reflected difficulties that went beyond questions of a practical field test or definitive conclusions. Because the records of the meeting are so limited the considerations and objections cannot be fully known for certain. Yet it seems possible that part of the problem with the proposal in the eyes of Rose and staff began with research that intended to analyze the role of diet in disease prevention. An analysis of the meeting is further complicated by the absence of the precise research proposal. If McCollum's proposal appeared as a vehicle encouraging individuals to accept greater responsibility for their health it might have been expected to receive Rose and others' support.

Whether or not the IHD staff requested McCollum to furnish a practical test or respond to their objections is also not clear. Within several months, however, McCollum provided a clearer indication of what he believed to be an important topic for research. His statement this time, however, appeared in a professional journal.

The 1923 article, reflecting years of research on nutrition, pointed to what McCollum believed to be a primary cause for poor diet in the United States. The essay began noting that Americans now consumed more cereals than had any other people in history. McCollum's concern stemmed not from the quantity consumed, but the nutritional quality. He stated his belief that nutritional value of this food source had declined dramatically in recent years as a result of changes in production techniques.

McCollum explained America's diet as part of a "nation-wide experiment in human nutrition" based on fewer and fewer industrially based foods. [32] He speculated that for many American families 90 percent of their diet consisted of white bread and other cereals, peas, beans, meats, potatoes, and sugar. He argued too that technological changes in agriculture and food processing were the most important elements which accounted for a general decline of diet in the United States.

McCollum judged processed cereal grains as the worst part of this diet. He noted that especially the bread wheats were deficient in essential nutrients: "The bolted flour from which our bread is made is poor in all the known vitamins." [33] Instead of prescribing how diets could be improved with milk or supplemental nutrients, he criticized the process that had led to the loss of value in traditional foods. At one time those foods provided a basis for health:

Steam transportation by rail or boat is less than a century old; before its advent every neighborhood tended to be agriculturally self sufficient. More attention was paid to gardening. There was a mill within a few miles of every household and a bag of grain was taken to be ground into flour or meal about once every two weeks. The household bread was made of whole wheat or corn. [34]

McCollum argued that the milling of cereal to remove bran in order to extend shelf life and the lapse of time between milling and baking often resulted in bread with little nutritional value. The movement from self-provisioning communities to a greater reliance on the milling and baking standards of industries provided a potential health hazard.

Nor did he limit criticisms to the industrialization of the American diet. He also held technological innovations

accountable as contributing to the problem of health and diet:

... grain farming was never possible on a large scale until the invention of the modern steel plow, the reaper, the thresher, and the steam engine for transportation. With these inventions farming of a new type became possible in regions which formerly were grassy plains... We have tried to change the nature of our food supply on a large scale without inquiring whether the changes were fraught with danger, as they actually appeared to have been.[35]

This analysis of the relation between diet and food processing offered potential health benefits that were of even greater value than the discoveries of vitamins A and D. This lesser-known part of McCollum's research failed to receive institutional or professional support necessary to achieve the status of a scientific 'breakthrough.'

Why did this pathbreaking research receive so little attention when so much of the work at both Johns Hopkins and the Rockefeller Institute emphasized work on nutrition? McCollum's proposal to the Institute, in retrospect, appears to have contained many of the qualities that characterized their work--interdisciplinary, potential benefits for public health, professional status, and related to ongoing studies. The answer to this paradox cannot be explained adequately in terms of research as determined by an objective rationale.

A central controversy in McCollum's description of the nutrition problem emerged with the identification of responsibility. In place of impersonal entities conventionally used to discuss diet (e.g., amino acids, enzymes, etc.) McCollum substituted a language ascribing social responsibility. Corporate food processors were presented as variables influencing caloric intake. Agribusinesses assumed a status tantamount to disease entities. Unrestrained commerce became an object of inquiry regarding the health of individuals. McCollum's suggested study, in contrast to prevailing norms that left institutions and class relations unexamined, began with the hypothesis that the most serious factor affecting diet and health was social. Indeed, his writings suggested an indictment of a social order that placed greater value on the production of capital than the generation of health.

The fact that McCollum's earlier work on particular nutrients gained prominence while his later interests remained obscured, reflected not only the power of the Rockefeller's managers of science, but also a collective norm among professionals at the Institute, Johns Hopkins, and scores of affiliated medical research centers.

The Rockefeller Institute did not take up the issue of food and medicine until the late 1930s. This research, involving Howard Schneider and Leslie Webster, limited the analysis of diet to considerations of its impact on the progress of infectious diseases. The Institute's researchers bounded their analysis, moreover, to a project remote from an examination of the social context: "the chemical nature of these accessory factors in dietary resistance to infection." The study was predicated therefore on divorcing diet and disease from the social context in which they occurred. What is more, the study lagged on until the 1940s and ended with what researchers labeled "a problem of enquiry." [36]

By the late 1930s the Rockefeller Foundation initiated research more directly concerned with altering social practices for the improvement of diet. This research mission incorporated, however, features more expansive than that of the Rockefeller Institute. Prior to the exploration of factors thought to influence diet, the Foundation gained many years of experience in designing and applying science in more public arenas. This included extensive programs concerned with agriculture as administered by the Foundation's General Education Board.

The General Education Board

Following the creation of the Rockefeller Institute in 1901, John D. Rockefeller approved the establishment of the General Education Board in 1903. During the early 1900s the General Education Board (GEB) used especially instruction about agricultural techniques among adults as a means of transforming rural society. Dr. Rose later stated the purpose in promoting 'scientific' education thus: "Promotion of the development of science in a country is germinal; it affects the entire system of education and carries with it the remaking of a civilization." [37]

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The GEB concentrated its first work in the southern United States. At the time it began operations in the South, the United States Department of Agriculture promoted a project of farm demonstration under the leadership of Dr. Seaman A. Knapp. In the autumn of 1903 the Secretary of Agriculture, Mr. Wilson, and the Chief of the Bureau of Plant Industry, Dr. B.T. Galloway, visited Dr. Knapp.[38] The project at that time involved the dissemination of methods to combat the boll weevil. Dr. Knapp organized farmers to adopt practices for the elimination of this pest and save the cotton industry from further destruction.

The Rockefeller managers of science soon learned of Dr. Knapp's work which dovetailed with Frederick Gates' recommendation in 1905 that the expanding philanthropy place primary emphasis on the promotion of "scientific agriculture." [39] Beginning in 1906 the GEB turned its attention to agricultural demonstration based on Dr. Knapp's demonstration method. Under the direction of Dr. Buttrick, an officer with the GEB, expenditures for farm demonstrations during the next eight years (1914) grew to nearly one million dollars.[40] The GEB recruited Knapp into its work in scientific agriculture that resulted in excess of 100,000 demonstrations of techniques designed to make agriculture more productive.

While Dr. Knapp's demonstrations included technical information about when, where, and how to plant a particular crop, the essence of the demonstration consisted of generating support among regional commercial and industrial interests. The interest of Rockefeller managers of science hinged on the stimulation of the South's economy and the transformation of agricultural production. For both Dr. Knapp and the Rockefeller Foundation, the science of agriculture emerged from the context of private accumulation of wealth.

As a method of demonstration, Dr. Knapp continually relied on the support of merchants, bankers, wealthy farmers, and other monied interests.[41] The monies received from the USDA and the GEB were combined with local capital that usually came under the control of a local businessmen's committee. The increased health of the agricultural economy in the South came only, however, with a reorganization of production. Dr. Knapp spoke with pride of replacing the "half-a-mule farmer" with the "four-mule-farmer." [42] Whatever specialized knowledge Dr. Knapp possessed of agricultural methods was accompanied by a disregard for the social consequences of his work:

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One of our demonstration farmers in North Carolina has been in the habit of employing four men and considerable day labor to cultivate his eighty acres of cotton each year. This year under demonstration he used our methods and found that the extra day laborers were not needed and even all of the four men he had always hired regularly could not be given employment. Thus, farmers are beginning to appreciate that the problem before them is to do more work with fewer men and to do the work better.[43]

This conception of the 'problem' subordinated rural people's livelihood to what others, the GEB and the USDA for example, referred to as a healthy economy. Although Dr. Knapp's sentiments may have been otherwise, the practice of his demonstrations supported an organization of agriculture as legitimately controlled by the monied classes and not those who tilled the soil. Seaman Knapp willingly placed the variety of techniques within a context of capitalist agriculture. Given this setting, Dr. Knapp explained that the method often involved the coercion of owners over workers:

Convince the owners of farms who reside in town that there is a way to get more rent; drive home the thought to the merchants that low earning capacity limits purchasing power; circumscribes trade and casts the constant shadow of uncertainty upon the day of settlement; awaken the banker to the fact that it is unwise to loan to men who farm the best land on a fourth of a possible crop, and poor lands on a tenth; . . . convince and arouse this land proprietor, this merchant and this banker, and they will not only give their influence, but will insist that all their tenants adopt the new methods.[44]

For members of the General Education Board, Dr. Knapp's methods of demonstration offered a means to develop "an agriculture readjusted to meet new conditions." [45]

GEB officers saw the operations of rural education blend with the engineering of a more prosperous agricultural economy: The big business drive in agriculture, spearheaded by the GEB's work in the South, led to the creation not just of a new system of agricultural education but of a new structure of power in the countryside." [46] Agricultural

demonstrations and the reorganization of productive activities provided a basis for generating public monies toward privately determined ends. "The Board promoted farm demonstrations in the South on the theory that agricultural prosperity would increase the taxable wealth of the South and thus enable the Southern States to support popular extension adequately." [47]

A central purpose of the Rockefeller managers of education derived from the perceived need to retool public skills in order to achieve a prosperous industrial base. The expense of providing skills for a large workforce amounted to considerable costs to industries; the purpose of the General Education Board involved organizing this training as a publicly supported institution. The GEB on one hand helped to define necessary training requirements operating with rural school agents and thereby "lead public sentiment in respect to taxation, consolidation, choice of teachers, etc." [48]

By the mid-1910s the Foundation's officers appreciated the value of organizing the public to fund institutions for an efficient, planned, and prosperous economy. Publicly supported educational institutions offered investments in human capital that otherwise might accrue to industrialists, thus cutting profits. Following the logic of bringing greater control of agricultural production under the control of regional capitalists developed by Dr. Knapp, officers of the General Education Board extended this control over the definition of scientific material that shaped the practice of agriculture:

Without promulgating or making itself responsible for any particular doctrine, the Board hopes to assist in ascertaining facts in order that practice may be in a position to utilize experience. Education will thus tend to develop like medicine, in which gradually a large body of scientific material has been accumulated and is being more and more made the basis of practice. [49]

A challenge for the General Education Board came with defining the agricultural sciences according to the practical needs of commercial interests. For a variety of reasons, however, the GEB never ventured far into a wedding of the agricultural sciences to the class interests of wealthy agriculturalists, food processors, agribusiness firms, and the like. Perhaps the strongest reason for this lack of

development in the management of the agricultural sciences derived from the relationship that had advanced to a considerable degree among scientists employed at land grant colleges, state agricultural experiment stations, and the United States Department of Agriculture.

From at least the mid-1900s on many of the early agricultural scientists in the United States had spent considerable time lobbying politicians, industrialists, and more commercialized farmers in order to gain support for research. Several generations of scientists promoted investigations, frequently serving the economic interests of the wealthy, as a basis for extending benefits to all social classes. The outcome, however, was that instead of aiding society's needy, it provided a means for the permanent elimination of alternative social relations:

The [Agricultural Experiment] Station would help the farmers to adjust to an increasingly competitive world market, would rationalize and systematize his operations---would provide, that is, a conservative alternative to more radical schemes for adjusting to changed economic and demographic realities. [50]

These more radical schemes included movements spawned by the agrarian unrest of the late 1800s.

The GEB defined its mission in technical agricultural demonstrations in the southern United States according to a complex of social institutions that reduced public participation. In spite of the popularity of various groups such as the Populists, the General Education Board never invited these representatives of agrarian labor. A later observer of the period noted, "Although the populist threat had disappeared, the memory of it was still vivid in the minds of members of grain exchanges, heads of farm equipment trusts, and directors of banks." [51]

The GEB's agricultural projects in the South constituted more than a general education of techniques; they also demonstrated to common farmers the limits of scientific discourse. Dr. Knapp and his associates linked a field of natural science perceptions to a particular segment of the society, i.e., the wealthy and their interests. At a general level the historic link of research to capital that the General Education Board fostered through the work of Dr. Knapp became manifest in dominant concepts. 'Productivity,' for

example, represented a core concept for both industrialists and geneticists. As will be argued in a later chapter, the ideal of productivity for most members of society was a dubious social good.

Another way of understanding the political values embedded in the language of science fostered by the Foundation appeared most strikingly in perceptions that linked agricultural research to public health. Especially at this point in the chain where agricultural scientists hoped to realize public benefits contradictory evidence appeared. As an example, the difficulty of achieving public health from research subordinated to private interests manifested itself in the advice Dr. Knapp gave to the owners of southern cotton mills:

The question is simply this: Is it cheaper to transport the food for the operatives in cotton mills from its northern base to the cotton centers of the South, or to ship the cotton bale to the food centers of the North? . . . General cultivation and use of rice in the South will solve the factory problem . . . laboring people, upon a diet of rice, though able to perform a large amount of work, complain of being hungry between meals. This was precisely what I wanted--energy with hunger.[52]

Dr. Knapp's counsel merged with that of another contemporary employed by the Rockefeller Foundation, Jacques Loeb. Both researchers conceived of man's health in terms of its value as a commercial commodity in the performance of work.

The International Health Commission (IHC)

John D. Rockefeller initiated work in public health in 1909 with the founding of the Rockefeller Sanitary Commission for the Eradication of Hookworm Disease. The Commission's orientation came from Rockefeller's interest in establishing public health as a means of demonstrating the virtues of medical research spawned by private philanthropy. Its work in public health anticipated in large part its later work in agriculture; in both cases Rockefeller sought an instrument for organizing the public:

Is there a disease affecting large numbers of people of which you can say, 'I know all about this and I can cure it, not in fifty or even eighty percent of the cases, but in one hundred percent?' . . . If you could name me such a disease you would not have to discourse in vague generalities about public health, but would have something concrete which the masses could understand, and concerning which they would be convinced by large-scale demonstrations.[53]

As a consultant to the Commission, Dr. Charles W. Stiles brought attention to the importance of hookworm as a major health problem, especially in the southern U.S.[54]

In proposing hookworm as a health problem the Rockefeller Sanitary Commission immediately recognized its value to business interests. Like its work in farm demonstration directed by Dr. Knapp, hookworm eradication promised to locate the meaning and benefits of health in terms of productivity, efficiency, savings, and concepts tied to the interests of capital. The characteristics used by Dr. Stiles to identify hookworm as a health problem were inextricably bound to the conceptualization of man as an instrument of production:

Dr. Stiles had already suspected that the people of the South had hookworm. The cotton-mill workers, like the Puerto Ricans, suffered frightfully from anemia. They would rest all day Sunday, work well Monday, get along fairly well Tuesday, be all tired out Wednesday, and thereafter do little work the rest of the week.[55]

The Rockefeller Sanitary Commission soon established a survey in North Carolina headed by Dr. John Ferrell. Like Dr. Stiles, Dr. Ferrell wrote of the debilitations caused by hookworm in terms that referred to the loss of productivity among afflicted workers.[56] Wickliffe Rose echoed these conceptions of the economic value of the proposed health project: "It takes, by actual count, about 25 percent more laborers to secure the same results in the countries where the infection is heavier."[57]

With the achievements of the Rockefeller Sanitary Commission for the Eradication of Hookworm Disease in the U.S. South, consideration was given to the expansion of these efforts internationally. This resulted in the creation in 1914

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of the International Health Commission, whose Director General, Wickliffe Rose, proceeded directly to determine the primary health needs internationally, but with particular emphasis on Latin America.

Because of the medical background of many of the members of the Commission, Director Rose and associates sought to gain a fuller understanding of Latin America. In March 1914 Dr. Ferrell wrote to Dr. Robert E. Swigart, the General Superintendent of the Medical Department for the United Fruit Company.[58] In his correspondence with Dr. Swigart, Dr. Ferrell asked what experience of the United Fruit Company might be of use to the International Health Commission. The fact that United Fruit had at least seven medical superintendents operating in six different Latin American countries represented information that might be of use toward improved public health. Dr. Ferrell's message to Dr. Swigart left no doubt, however, as to the kind of 'public' health sought by the International Health Commission: "If we can improve the health of the people in those countries where you are transacting business it would doubtless be much to the interest of your company."[59]

Within a month Dr. Swigart responded to Dr. Ferrell: "... we will take pleasure in giving you the benefit of our organization and experience in all countries where we operate, and I will again call your attention to the fact that Dr. White is personally acquainted with all our representatives."[60] Dr. Swigart added that all of the medical superintendents had received instructions to cooperate with the members of the International Health Commission. In subsequent years close cooperation marked relations between the Foundation and the United Fruit Company.

The work of the Commission's personnel emphasized hookworm as nearly the exclusive subject of their campaigns. Although the local populations certainly realized benefits, health problems that did not affect the productivity of laboring populations and the condition of non-wage earning groups remained largely unchanged. The major benefits of the International Health Commission's work accrued to the owners of plantations in Central and Latin America. A 1918 Commission study of hookworm treatments in Costa Rica, for example, reported its achievements in terms of dramatic increases in productivity.[61]

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The International Health Commission did not, however, limit its activities to the needs of the United Fruit Company and its laborers. Although the interest of the Foundation in Mexico dated from 1913, the protracted conflicts of the Mexican Revolution had made any organized effort difficult at best. With the containment of the more revolutionary elements in the early 1920s, including the murder of Emiliano Zapata, the opportunities for resumed commerce and institutionalized health projects became once again feasible.

Although the IHC had conducted extensive investigations of hookworm in other parts of Latin America, its first operations in Mexico were directed at yellow fever. Even though hookworm constituted a health problem in Mexico, the perspective of the IHC's major client in Mexico--petroleum manufacturers--placed major emphasis on the control of yellow fever. The main purpose of the IHC mission in yellow fever derived from the need of the oil companies to have a healthy and productive work force.

In a report prepared for the IHC, Dr. M.E. Conner explained the history of yellow fever in the regions of oil production as intimately linked to "the commercial history of the area." [62] Dr. Conner noted that while yellow fever had existed for many hundreds of years in Mexico, it became a problem primarily as a function of commerce. Indeed, the history described by Dr. Conner suggested that the epidemic proportions of the disease occurred as a result of uneven economic development in Mexico.

While yellow fever certainly caused death and debilitation among Mexican populations, Dr. Conner reported that when a population remained stationary the infection of yellow fever soon eliminated itself. The most important source in the spread of the disease, according to Dr. Conner, came from the importation of labor from one region to another: "As in other industries, the henequen producers experienced years of crisis in which no labour was imported, and in these years the yellow fever cases were less, and if the crisis continued long enough the infection was eliminated through failure of the human host." [63]

Dr. Conner's history of yellow fever exemplified the political nature of choices in the IHC's work. If the immediate objective of the Commission's work involved the alleviation of human suffering, a practical health measure to prevent further cases of yellow fever included the discouragement of labor migration. While certainly the control of a particular pathogen was also desirable, other members of

the Commission recognized that in the region of oil production other conditions existed to suggest adverse consequences to health beyond that of yellow fever. In a narrative report supplied to the Commission in 1922, the following description of the conditions of life for Mexican workers in the petroleum producing region of Tampico appeared:

The public facilities . . . are now fearfully inadequate. This applies especially to the supply of water which is at all times insufficient, and which sometimes fails altogether for weeks at a time . . . The officials of the large companies live in modern colonies, and enjoy practically all modern conveniences, but at a rather high cost. This high cost operates all down the line, so that it puts decent living entirely out of the reach of the poorer classes, who, although receiving more wages in money than they ever did before, still can not afford anything better than a rude shack of boards, grass, paper and sacking. The people live entirely without sanitation of any kind, for there are no sewers in the parts of town given over to their hovels, nor do they have any water other than what they buy from itinerant peddlers who sell water at 20 cents per 5 gallon tin.[64]

The report, from a public health perspective, suggested many other social pathogens at least as serious as that of yellow fever. The IHC's professionals, however, concurred with the owners of Mexican petroleum production. The 'crisis' according to these interests appeared in terms of labor productivity and not the health of laborers and their families.

The Foundation referred to the mission to combat yellow fever in Mexico as the Special Commission for the Campaign Against Yellow Fever. The Special Commission originated not as an agreement with the Government of Mexico, but between the Foundation and private commercial interests. Prior to the IHC's formation of a special commission a Special Committee of the Oil Association representing oil producers from Tampico attempted to control yellow fever.[65] The Special Committee formed by the Oil Manager's Association formed in October 1920 and operated until July 4, 1921 "when the work was taken over by the Rockefeller Foundation." [66] The International Health Board (IHB) located the campaign to

eradicate yellow fever, appropriately enough, in the offices of the Oil Manager's Association in Tampico.[67]

In spite of the IHB narrative report and its suggestion of a much wider mission in public health, the Foundation limited its activities to a mosquito eradication program. The other dimensions of public health remained outside of the private health measures that the oil producers had particular interest in achieving. The little regard that the Foundation's director of the yellow fever campaign had for the laboring classes followed, moreover, not from considerations of their health but from assessments of their politics:

My general impression is that the greater part of the population between Vera Cruz and Tampico (and including both places) is more than tainted with Bolshevistic doctrines, and that this one area is going to cause the Mexican government no end of trouble. At present there is a state law in Vera Cruz that is intended to compel every manufacturer, or employer of labor, to divide from 10% to 50% of his net profits with his employees.[68]

The seemingly dubious link that the ideology of Mexican workers had with respect to health represented nonetheless merely the inversion of the preferential attention that Rockefeller scientists gave to the owners of capital. The practice of medicine according to the interests of capital reflected a continuing theme of the International Health Board worldwide.

In addition to its work in Latin America, the International Health Commission also organized public health programs in Asia. The Director for these operations, Victor Heiser, immediately acted to organize health according to local financial and commercial interests, especially plantation owners. A conversation recorded by Dr. Heiser evidenced the commercial value of certain kinds of health as explained to the Chairman of the Estates Agents Association, representing absentee landlords from England, in Ceylon:

Dr. Heiser: How many laborers do you have to import?

Chairman: About a hundred thousand a year.

H: That runs into quite a sum of money, doesn't it? Now on every estate you have a hospital.

It may be large or small, but it is constantly occupied. Doctors and nurses alone must cost you a lot. And am I correct in assuming that you have to pay your laborers whether or not they are working?

C: Yes.

H: Suppose that we [the International Health Commission] could reduce the hospital expense by half.

C: That would certainly save us a great deal.

H: Here's another important point to be considered. The Tamil women tend to be sterile because of anemia from hookworm. If they could produce children, you wouldn't have to bring over fresh labor all the time. You could raise your own. Wouldn't that be advantageous in the long run?

C: It would increase our profits tremendously--that goes without saying.

H: So health and the planting business have something in common after all?[69]

Another member of the Commission, John Grant, traveled to China in 1917 as the associate director of the hookworm survey. Grant first trained with the Sanitary Commission in North Carolina where he referred to the Rockefeller Foundation's work as "the attainment of the objective of a new social order." [70] This idea of the 'new social order' meant not only the application of science, but the development of science in terms of the social context. In China, Mr. Grant urged the Foundation to train business leaders in matters of public health. [71] When the Foundation later established the Peking Union Medical College, the resident director, Roger Greene, echoed Grant's proposal that the Foundation work toward "creating a better understanding between the bankers and the Chinese government . . ." [72]

Another facet of the Foundation's international programs involved science as an instrument for defeating those antagonistic to capitalism. This represented an especially important facet of the Foundation's work in China. Harry Cleaver's research describes in great detail the active participation by the Foundation in both its attempts to extend U.S. influence and to create conditions propitious for the expansion of capitalism. [73]

It would be a mistake, however, to regard the 'new social order' as merely shallow subterfuge to impose foreign domination in economic and political spheres via science. While Rockefeller scientists actively encouraged conditions in which agendas for research blended with the requirements for capital accumulation, their advocacy rested in a seemingly inescapable commodity: scientific knowledge. And even though these scientists might be indicated for their complicity as agents of capitalism and U.S. interests, was not their talent necessary to every society? Did the Rockefeller Foundation simply encourage the misappropriation of science by its support of capitalism or did the problem run deeper and reflect a fundamentally subverted science? Some tentative answers to these questions appeared in the reorganization of the Foundation in 1928.

Science and the Reordering of Society

By the early 1920s the Rockefeller Foundation's managers of science grew more convinced that the application of research constituted the key to bringing order and prosperity to a chaotic world. The early challenges to control a particular disease or to eradicate a pest in agriculture each confirmed the value of science as a means of rationalizing the social order. Together the officers of the Foundation saw in science the means for transcending the traditional social mechanisms, particularly government, that failed to maintain the stable conditions that were essential for the advance of science, commerce, and society. Science offered a potent alternative for decisions that extended from the workplace to definitions of the good society.

One of the first proclamations exclaiming the virtues of extending science beyond the laboratory and into public life came from Wickliffe Rose, "all important fields of activity, from the breeding of bees to the administration of empire, call for an understanding of the spirit and technique of modern science." [74] In his 1924 statement before the General Education Board, Rose stated, "Science is the method of knowledge. It is the key to such dominion as man may ever exercise over his physical environment; appreciation of its spirit and technic, moreover, determines the mental attitude of a people, affects the entire system of education, and carries with it the shaping of a civilization." [75] The Board of Trustees echoed Rose's attitude toward science in the minutes of the meeting in which the

General Education Board was reorganized into the International Education Board: "Convinced that on the whole the progress of civilization coincides with the increase of accurate knowledge and the spread of objective and dispassionate spirit of scientific inquiry, the Board is now definitely undertaking to cooperate in the improvement in the United States of conditions favorable to the development of the physical and biological sciences." [76]

With the reorganization of the Rockefeller Foundation in 1928 Rose's attention to the role of the natural sciences grew to include other disciplines. The newly formed Division of Natural Sciences, headed by Warren Weaver, envisioned biology, physiology, and allied fields as the mechanisms for making society more scientific. In a 1933 paper Weaver wrote: "There is the possibility, based on knowledge of physical laws and understanding of natural processes, of bringing individuals into a more intelligent, a more accurately adjusted, and a happier relationship with our modern scientific civilization." [77]

In 1934 Warren Weaver called upon the Foundation to support a program in psychobiology. This program in many ways encompassed the essence of what Weaver and others conceived to be the promise of the scientific civilization--the organization of mankind around the factual knowledge that explained man's behavior. Society no longer had to wonder about how best to organize social relations; it needed only to develop tools sophisticated enough to obtain and administer the scientific knowledge necessary to achieve this state. Weaver outlined for the Trustees how science could be used to replace the current "terrific tension" in society:

Can we develop so sound and extensive a genetics that we can hope to breed, in the future, superior men? Can we obtain enough knowledge of physiology and psychobiology of sex so that man can bring this pervasive, highly important, and dangerous aspect of life under rational control? Can we unravel the tangled problem of the endocrine glands, and develop, before it is too late, a therapy for the whole hideous range of mental and physical disorders which result from glandular disturbances? [78]

The proposal for what Weaver termed 'a new science of man' was nothing less than revolutionary.

This new science departed completely from the traditional notion that scientists performed a neutral inquiry and nothing more. The Director of the Natural Sciences advanced the notion that scientific knowledge, as contrasted to other kinds of understanding, assume final authority in society. The fruits of research as derived from investigations at the Rockefeller Institute, Johns Hopkins, or even land grant colleges would combine and "rationalize human behavior." Scientific inquiry would replace the perennial political questions about the good society with the objective processes identified by scientists.

Weaver's proposal, while novel, found support among both older and newer members in the Foundation. Wickliffe Rose also expressed the idea that science represent not only a means, but a goal around which society be organized:

Whether we will or no, civilization has become increasingly a matter of applied science. To be sure, science can be and is misapplied, but this is not to be laid at the door of science. Health, transportation, food, education--these are realms of activity that cannot be properly managed until more is known. The increase of knowledge upon which human welfare depends comes largely from the laboratories dealing in the most fundamental fashion with the physical and biological sciences. [79]

With the reorganization of the Foundation in 1928, in which the Boards (International Education and Health) were transformed into divisions (the natural sciences, medical sciences, and social sciences), the philanthropy's objective turned toward an experimentation in the application of science to alter social arrangements.

A prominent personality in the reorganization of the Foundation was J.D. Rockefeller's chief counsel, Raymond B. Fosdick. Fosdick's reasons for recasting the Foundation according to divisions of science instead of project areas aimed at the promotion of certain kinds of knowledge more widely in society. In place of support granted to specific islands of knowledge (e.g., research laboratories), the Foundation's advisers conceived of their mission as "promoting procedures in the rationalization of life." [80]

Under Fosdick's leadership as president of the Foundation and with the cooperation of Warren Weaver in the Division of Natural Science, the management of science pursued the following objectives:

- (1) The unique opportunities open to the Rockefeller Foundation are not met by supporting scientific projects merely because they are science, or even because they are outstandingly good science. . . . It is proposed for the future program that interest in the fields in question play the dominant role in the selection process.
- (2) This principle of functional concentration calls for three changes in emphasis. First, a considerably increased proportion of expenditures should be devoted to the development of the few selected fields. Second, capital grants for general scientific purposes should practically cease in the United States and Western Europe, and should be restricted to relatively backward countries. Thirdly, the fellowship program, and to some extent the grants-in-aid program, should be pointed toward the adopted fields of interest.
- (3) The choice of fields . . . must be sufficiently developed to merit support, but so imperfectly developed as to need it; it should be a field in which the contributions of the Foundation will play a critical role in producing and stimulating development that otherwise would not occur within a reasonable time.
- (4) Science has made magnificent progress in the analysis and control of inanimate forces, but science has not made equal advance in the more delicate, more difficult, and more important problem of the analysis and control of animate forces.
- (5) A small provision should be made in the budget of the program to care for unpredictable and unquestionable opportunities.[81]

The five point agenda developed in the early 1950s signaled the culmination of accumulated years of experience in the management of science. The promotion and production of knowledge began with a vague recognition of the importance in distinguishing between different kinds of science. Over the years the Foundation's managers of science noted the value in distinguishing between science and non-science. This difference had less to do with internal criteria, such as logic.

The Foundation learned that the practical difference derived more from its value for guiding social practice.

The second point revealed the crucial difference that strategically placed sums of money had in establishing a dominant science. In public health programs around the globe, Foundation scientists discovered an ease at introducing their definition of medicine and subsequently guiding public policies accordingly. While the opportunity for the use of science to lead public agendas grew more restricted in the developed countries, the opportunities in the underdeveloped states remained plentiful. An especially potent instrument in this process was the creation of a professional indigenous force, trained to emulate standards and practices devised by Foundation personnel.

The third element of the plan represented the most crucial aspect in the use of science to transform society. With sufficient care and planning, knowledge touted as science offered an ideal means for structuring social development. Fosdick referred to the use of science in this fashion as "an entering wedge." [82] Disciplines that provided Rockefeller scientists some discretionary judgment were naturally preferred because of the increased opportunity to program outcomes as though intrinsic to science.

The fourth plot reaffirmed the Foundation's primary objective in the management of science: to place control of society within an allegedly neutral process based on true knowledge. Whatever differences existed between the various managers of knowledge--F. Gates, W. Rose, W. Weaver, or R. Fosdick--all agreed that science must hold a dominant position in society. These men were in this sense no different than their contemporaries who worked in industrial laboratories, land grant colleges, or government bureaucracies. Knowledge derived from the scientific method of positivism/empiricism constituted the legitimate basis for decisions in society. Science constituted a final authority, one that superseded even that of the State.

This fourth point contained an essential problem in the listing of objectives. First of all, if the Foundation participated in the identification of science, as well as non-science, in what way could this be said to be objective or constitute 'truth?' What was the difference between a "sufficiently developed" science and an "imperfectly developed" one? How did the Foundation's managers of science make this distinction and what were the consequences for society? Did

the Foundation merely substitute an ostensibly objective process that provided it greater control and thereby replace the State?

Instead of dealing with these contentions in the abstract, we can review the first program designed around these principles--the originating project of international agricultural research. The history and development of the Rockefeller Foundation's work in Mexican agriculture represented what Warren Weaver later referred to as the experiment designed to implement the above-mentioned objectives. Our paramount concern is what the Foundation's achievements in science mean for mankind.

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3

Identifying the Problem in Mexican Agriculture, 1940-1950

What was the problem in Mexican agriculture in 1940? How did the Foundation 'discover' the solution? These two questions illuminate the ways in which the Rockefeller Foundation influenced the course of Mexican agricultural, and thereby social and economic, development. The location of the problem eventually reappeared in the agendas of the first international agricultural research centers. In spite of its inauspicious beginnings, the small team of scientists that initiated work on Mexican agriculture in 1943 shaped a model of technical assistance that, by today, has touched nearly every country in the world.

The Foundation's earlier experiences in the management of science provided important lessons used to organize its work in Mexico. In this chapter we will review some of the factors that led to the formation of the Mexican Agricultural Program (MAP). The purpose is to show that the proposal to improve Mexican agriculture possessed alternative paths of development.

When the government of Mexico and the Rockefeller Foundation formalized a general agreement in 1943 there remained important specific objectives to decide upon regarding the nature of the mission. This mission, far from being a straightforward application of 'science,' contained several competing ideas about what sciences were necessary for Mexican agriculture. These alternatives reflected not simply different visions about the objectives, but distinct conceptions about the meaning and purpose of science.

In 1913 the Rockefeller Foundation established a public health mission in Mexico. By the early 1930s the mission had trained numerous Mexican students in public health at U.S.

universities. Many of these returning trainees were assigned to strategic positions in the national health department.[1] Dr. J.A. Ferrell, a Rockefeller Foundation officer involved in public health, remained concerned about Mexico's economic development. Ferrell reported that one of the most urgent needs in Mexico was a program to improve economic conditions. Because the average Mexican family was too poor to pay taxes, Ferrell stated that funds were unavailable to finance such services as health, education, and welfare.

In 1936 Dr. Ferrell spoke with a former minister of agriculture, who had served ex-president Calles, about the possibility of establishing a cooperative mission in agriculture between the Rockefeller Foundation and the government of Mexico. The former minister of agriculture assured Dr. Ferrell that such a mission might be welcomed by then President Lazaro Cardenas. Ferrell then wrote a memo to the president of the Rockefeller Foundation, Raymond Fosdick, about the possibility of establishing a mission in agriculture:

A beginning toward economic improvement could be undertaken in the field of agriculture. No serious controversial issues would be involved and ultimately the range of aid might be broadened.

Except in public health, I have not attempted to mature a project for Mexico, but I believe two or three qualified persons might be sent to study its agricultural problems and possibilities and then outline broadly a constructive program. Again, a small number of carefully selected Mexicans might be given fellowships for special training in other countries. When they returned for duty, they might be given some financial aid through proper channels toward organizing and conducting activities.[2]

Dr. Ferrell's plan was not immediately acted upon by the Rockefeller Foundation. The reasons for this were not explained in information available in the Rockefeller Foundation Archives, but were probably the result of political events in Mexico. The political administration of Lazaro Cardenas facilitated the worsening of relations between the United States and Mexico. Lazaro Cardenas quickly proved to be uncooperative with U.S. interests. By 1938 President Cardenas expropriated the Standard Oil operations in Mexico

and threatened U.S. investments in other parts of Mexico as well.

In 1940 the political climate in Mexico changed substantially with the election of Avila Comacho. Later observers placed much on this fact in conjunction with the then still pending outcome of oil expropriation between Mexico and Standard Oil. Although the Rockefeller Foundation did not always act as a means of supporting Rockefeller business interests, there may well have been some motivation on the part of the Trustees to pursue work in Mexico that supported a political machine, Comacho's, which would favor an outcome amenable to U.S. interests, including those affecting the Rockefeller investments in Mexico.[3] But this did not represent the totality of Foundation interests in Mexico. The problematic concern with Mexico, specifically in terms of its agricultural development, was the absence of a means of capitalizing operations in the countryside. In this sense, the link of efficient production predicated on a capitalist economy only had a remote and unclear relation to the immediate problems of expropriation. While the principles behind this mode of agricultural development mitigated against future 'problems' of this kind for foreign capital in Mexico, the Foundation's activities in Mexico held little promise for the resolution of specific contentions brought about by Lazaro Cardenas. The objectives were much larger--to create a situation in which agriculture pursued an agenda of capitalist development.

The Foundation's chronicle of events as reconstructed from various documents points to the initiation of the Mexican Agricultural Program by a personality outside of the Foundation--Henry A. Wallace. Henry A. Wallace rose from a generation of successful farmers to become, by 1940, Vice President of the United States. Later, as a Secretary of Agriculture, he epitomized those agriculturalists who had successfully adapted industry and finance to their farms. Indeed, Wallace liked to think of himself as the 'father of industrialized agriculture.'[4]

Henry Wallace also represented the archetypical progressive. While Wallace appeared to understand that agricultural policies necessary of industrialized production often resulted in greater hardships faced by certain farmers and labor, he treated this as an acceptable consequence. During an episode in 1935 Wallace participated in the purging of a group of lawyers from the Agricultural Adjustment Administration (AAA). Wallace later wrote about the decision

to remove the counselors backed by "left wingers" as "wanting to move too fast." [5] Various legal counselors to the AAA reversed a previous ruling and held that landlords who received federal cotton subsidies had to respect the rights of their tenants ". . . to keep the same tenants in the same houses on the same land." [6]

On February 3, 1941, as Vice President Wallace met with Dr. Ferrell and Raymond Fosdick at the Senate Office Building in Washington, D.C., he stated that among the important problems confronting Mexico was the need for greater agricultural production. Wallace suggested that demonstrations of agricultural practices should be located in the densely populated central plateau. Wallace further stated that while the Rockefeller name was generally associated with philanthropy, "it might also be linked with the oil industry, expropriated property, and the attendant controversies." [7] When questioned on this point, Wallace responded that the Rockefeller Foundation was regarded as apolitical and that it had advantages over alternative programs, such as between the governments of the United States and Mexico.

Wallace also commented that his concern over low agricultural productivity was the result of the "possible danger" that this made in the face of a high birth rate. Wallace stated that he and the U.S. ambassador to Mexico, Mr. Daniels, felt that President Comacho "wants peace with the United States and that a basis for the settlement of controversies about American property is in prospect." [8] The Vice President concluded the meeting with an emphasis on the importance of Mexico in the national defense of the United States.

In subsequent conversations within the Foundation it was agreed to organize a survey team as suggested in Dr. Ferrell's memo of 1936. The 'qualified persons' selected to review Mexican agriculture included three scientists of agriculture: Dr. E.C. Stakman, professor of plant protection at the University of Minnesota; Dr. Richard Bradfield, professor of soils and agronomy at Cornell University; and Dr. Paul Manglesdorf, professor of plant genetics and breeding at Harvard University; . [9]

In July 1941 the three American scientists traveled to Mexico. By December the survey team had completed its survey and issued an evaluation of the feasibility for 'technical assistance'. The program of technical assistance proposed by Stakman, Bradfield, and Manglesdorf included:

1. Breeding improved varieties of maize, wheat and beans;
2. Developing improved agronomic-production-management practices;
3. Improving weed control;
4. Improving animal production;
5. Training a corps of Mexican scientists. [10]

Although their observations were circumscribed by a study of feasible technical assistance, the prescriptions of the survey team reflected a commitment to science.

The observations by Stakman, Bradfield, and Manglesdorf of Mexican agriculture demonstrated their fundamental belief in the importance of scientific agriculture. These scientists described "genetics and plant breeding, plant protection, soil science, livestock management, and general farm management" as the means of improving the five areas of technical assistance listed above. Their proposals for Mexican agriculture, instead of reflecting scientific disinterest, reflected an advocacy of 'scientism.' Science was viewed not merely as a method for improving agriculture: science was also to provide technique as the only means by which to improve agriculture.

In a book written later recording their observations of Mexican agriculture, Stakman, Bradfield, and Manglesdorf addressed the role of agrarian reform in Mexican agriculture:

Agrarian reform had long been one of the principal aspirations in Mexican revolutions. . . . Mexico was being transformed largely from a country of latifundia to one of minifundia; whereas a few people had owned much of the land, each of many people now farmed a little land. . . . Land redistribution was satisfying the hunger of the landless for land, but was it satisfying their hunger for food? [11]

These scientists argued for the "encouragement, stimulation, and guidance of existing institutions and individuals." [12] But such arguments obscured the sharp cleavages that existed between personalities and within institutions. In the aftermath of the revolution and controversies renewed by the Cardenas administration, was the improvement of agriculture to occur amongst private hacendados, ejidatarios, or the landless?

The survey team did not attempt to answer questions concerning who was to be the recipient of its programs except as a general strategy involving the scientific improvement of agriculture. In a confidential memo to the Rockefeller Foundation, the three scientists suggested a strategy of how and where technical assistance should begin:

The plan presented assumes that the most rapid progress can be made by starting at the top and expanding downward. The alternative would be to start at the bottom and work toward the top. A program of improving the vocational schools of agriculture and of extension work directed toward the farmers themselves might be undertaken. But the schools can hardly be improved until extension men are improved; extension work cannot be improved until extension men are improved; and investigational work cannot be made more productive until investigators acquire greater competence.[13]

But who or what exactly possessed the competency to determine the source of problems in Mexican agriculture? While virtually all of the histories of this period presented agricultural scientists as though monopolizing the intelligence necessary to solve Mexico's 'problems,' this period actually represented one of the most contested and controversial episodes in the origins of international agricultural research.

Prior to the visit by Stakman and other members of the team to Mexico an officer of the Foundation suggested that the views of someone familiar with Latin America be solicited regarding technical assistance to Mexico. Dr. Carl Sauer, a professor of geography with the University of California at Berkeley, was suggested as a person who was "in entire sympathy with the importance of focusing on agriculture." [14] The Foundation was acquainted with Sauer through his proposals to the Foundation and subsequent work on projects in Latin America.

Dr. Sauer recommended that the improvement of the genetic base of agricultural crops be predicated on an understanding of the relation of such work to the poorer segments of the society. As an example, Sauer suggested that improvements in agricultural production could be directed to the rural poor by considering the role of various foods in their kitchens. The nutritional practices of the Mexican peasantry

(campesinos) Sauer stated, were excellent as far as their pocketbooks allowed. The same was said to be true of the agricultural practices. Sauer stressed that the main problem confronting the Mexican was one of economics, not culture.[15]

In concluding his remarks on agriculture, Sauer reminded the officers of the Foundation that plants such as maize had a much more varied use in Mexico than was true of the same plant in the United States. As a result of these differences, Sauer cautioned against applying the agricultural sciences to recreate the history of U.S. commercial agriculture in Mexico.

A good aggressive bunch of American agronomists and plant breeders could ruin the native resources for good and all by pushing their American commercial stocks. . . . And Mexican agriculture cannot be pointed toward standardization on a few commercial types without upsetting native economy and culture hopelessly. The example of Iowa is about the most dangers of all for Mexico. Unless the Americans understand that, they'd better keep out of this country entirely. That must be approached from an appreciation of native economies as being basically sound.[16]

Dr. Sauer's evaluation was distributed to members of the Foundation including: Raymond Fosdick, John A. Ferrell, A.R. Mann, and Andrew J. Warren. Dr. Sauer's emphasis of building on the knowledge of agriculture possessed by the peasantry generated little discussion among members of the Foundation. In spite of the severity of Sauer's observations, the Foundation set the stage for the management of science according to the logic of commercial production.

Several years later, in February 1945, Joseph Willits, director of the Social Sciences for the Foundation, received a letter from Carl Sauer. Sauer, during a trip through Mexico, met with Drs. Wellhausen and Harrar and forwarded another evaluation of Mexican agriculture and the role of the MAP to Dr. Willits. The Foundation's officers had asked George Harrar to lead the MAP and Edwin Wellhausen to serve as one of the MAP's first scientists. Sauer wrote that he was impressed with Dr. Wellhausen and commented that Edwin Wellhausen was not one of those "natural scientists who remain unaware of the cultural medium in which they are working . . ."[17] Sauer commended Wellhausen in his letter

to Dr. Willits, saying, ". . . he sees that they [the members of the MAP] must work with the native corns; he is not a missionary for soybeans, and I suspect he sees the pitfalls in the wheat campaign." [18]

Sauer argued against the campaigns to increase the cultivation of wheat in Peru and Chile as well as Mexico. Sauer wrote that work on the cultivation of legumes was much needed by Mexican households. Moreover, Sauer argued that local varieties of corn were of much greater value to local communities than would be the research pursued by the MAP on barley, alfalfa, and wheat--commenting that "the 'natural' place for these small grains in the local economy is pretty restricted, I think". [19] Sauer noted that the absence of legumes in the diet of many Mexicans was the result of historic factors, not environmental ones. Sauer described the example of the Spaniards' emphasis on the cultivation of wheat and barley as ill-suited to the ecology and economy of Mexican villages.

Although Sauer spoke of the need to help the Mexican peasantry, he placed considerable value on their accumulated knowledge and skills, especially in agriculture. Sauer repeated his earlier assessment to the Foundation, stating that the Indians of Mexico "need to be encouraged that their ways are good and they need protection against exploitation." [20] Sauer's concern for the peasantry reflected an interest in understanding the meaning of agriculture as defined by its participants.

I am not interested in the Indians as museum pieces and I am also interested in non-Indian populations that have cultural values of their own as apart from the standardizing tendencies which are flowing out from the urban centers to strip the country of its goods and ables men and pauperize it culturally as well as often economically. [21]

Sauer analyzed critically Mexican agriculture as a reflection of the United States' model of development:

The agricultural situation in Mexico is an exaggeration of that which we have in our experimental work in California; the interest is directed away from subsistence or village agriculture to the needs of city and factory with the attendant emphasis on standardization of product and on yield,

also on tariff protection, and on the commodities which the privileged fraction of the population can absorb. [22]

Carl Sauer's suspicions about the Rockefeller Foundation's program of agricultural science was, what is more, only a part of the criticism directed at the mission of the Mexican Agricultural Program. The Foundation also possessed studies produced by its own staff that had corroborated Sauer's criticisms in terms of the agriculture-health nexus. Between 1942 and 1945 a series of nutritional appraisals were carried out in Mexico by the International Health Division (IHD). These appraisals were conducted by the cooperative mission established between the IHD and the Mexican Ministry of Health. These village-based studies represented one of the best windows the Foundation and its scientists had as a means of understanding the relationship between common agricultural practices and diet.

One of the studies, based on villages in Michoacan and Guanajuato, categorized the diet of common folks. [23] This diet was described as composed of locally grown foods that included corn tortillas, beans, chili peppers, and often a few other foods. The studies documented that the diet reflected low calorie and protein intake. The investigators stated that insufficient amounts of riboflavin and niacin were also characteristic of this diet. Yet, in spite of the meager diet, the IHD investigators gave little reason to support a change in the sources of food:

The common dietary pattern among the people living in this region was found to be fundamentally sound . . . While there is room for improvement in the quality and quantity of the average Mexican diet, there seems to be no necessity to change the pattern of this diet. [24] [Emphasis added]

In another village-based IHD study, in the state of Mexico, diets were found to be adequate:

. . . in spite of the barrenness and poverty of the region, its inhabitants have through many centuries developed food habits and a way of life adapted to the area . . . [and by] eating tortillas and every conceivable edible plant available, a fairly good diet is maintained. [25]

While each of these studies supported a program of increased productivity, they cautioned against both the types of method and kinds of crops to be introduced. Like Sauer's reports, the IHD surveys were sufficient to cast doubt on the wholesale transfer of a U.S. model of agriculture. Indeed, one of the latter reports paralleled Sauer's suggestion that the problems in Mexican diet--like agriculture--could not be answered by natural scientists working without regard for the social context: "Attempts to change dietary habits in this region would be a mistake until economic and social conditions can be improved." [26]

In addition to the criticisms of a program limited to increased agricultural production as advocated by Stakman et al., Sauer offered an alternative scientific project based on a union of natural and social inquiry. As early as 1943 Sauer wrote of his collaboration with another scientist and their work toward this alternative:

I am working on a long-term research program dealing with the domesticated plants (and animals) of the New World. . . . The Rockefeller Foundation is sending out a first class geneticist, Edgar Anderson, from the Missouri Botanical Garden. . . . We have been feeling our way here into something, and it is getting an increasing expression through some of our students. . . . [We] are all going in the same direction, which is a union of plant phylogeny, physical geography, and historical cultural geography. [27]

Sauer's proposal offered a means for placing investigations of the physical environment within an assessment of social conditions and historic context.

In spite of later histories that portrayed the role of U.S. agricultural scientists in Mexico as unproblematic, the Foundation faced serious challenges and criticisms about the application of U.S. agricultural science as a means for solving Mexico's 'problem.' Yet the record which testifies to the ill-conceived and problematic nature of the Foundation's mission in Mexican agriculture reveals that the Foundation's leaders as well as consulting scientists gave little thought to the criticisms of Sauer and others. One of the few discussions generated by Sauer's memos of 1941 and 1945 appeared only in the late 1940s. Paul Mangelsdorf wrote to Warren Weaver in 1949 a summary explaining the opposition

by Carl Sauer and Edgar Anderson to the Mexican Agricultural Program:

If the program does not succeed, it will not only have represented a colossal waste of money, but will probably have done the Mexicans more harm than good. If it does 'succeed,' it will mean the disappearance of many ancient Mexican varieties of corn and other crops and perhaps the destruction of many picturesque folk ways, which are of great interest to the anthropologist. In other words, to both Anderson and Sauer, Mexico is a kind of glorified ant hill which they are in the process of studying. They resent any effort to 'improve' the ants. They much prefer to study them as they now are. [28] [Emphasis added]

The 'other words' used by Mangelsdorf to interpret what Sauer and Anderson critiqued in the Mexican Agricultural Program did fundamental violence to their arguments. It is important to recognize that the Foundation's trivialization of these criticisms reflected a norm that was more encompassing than that which characterized the Foundation's management of science. Mangelsdorf's remarks also illustrated a legacy of positivistic science in which the fragmentation of knowledge into social and natural science facilitated the dismissal of criticisms challenging claims of certain knowledge.

Limiting Scientific Responsibility

The decision to not work for a science that was controlled by the powerless in society was consonant with other decisions made by American agricultural scientists. The recognition that such an organization of agriculture was bound to produce further class antagonisms and inequities was anticipated early on by the Rockefeller scientists. In 1949 Warren Weaver invited three of the Foundation's trustees to Mexico to see the MAP's achievements. After the visit by Dr. John S. Dickey (President of Dartmouth College), William Meyers (a dean at Cornell University), and Dr. Thomas Parran (a dean at the University of Pittsburgh), Weaver asked each of these trustees to consider two questions regarding the Rockefeller program in Mexico. [29] Weaver queried each about (1) what were their ideas about the Foundation's method of withdrawal from Mexico, and (2) "how could we capitalize" on

the "useful administrative, organizational, and technical procedures" that were developed by the MAP?

John S. Dickey responded that various members of the Foundation agreed that the program should not be ended abruptly. Dickey commented that the program could not be carried on indefinitely and the program might be terminated as early as 1953 or 1955, but that this depended on the agreement of a "limiting principle." Dickey suggested one version of a limiting principle and how and when the Foundation members might agree to terminate the program in Mexican agriculture:

. . . I suggest that one of our limiting principles might be that we will not carry the program beyond the point where it has been established as a scientific success; to put it otherwise, that the Foundation is not and will not be primarily concerned with the long-range problems of practicality involving major political, economic, and social decisions and operations.[30]

For Dickey the limiting principle was based on his anticipation of the social consequences of introducing different agricultural techniques.

Although Dickey acknowledged that the MAP had been drawn into demonstrating its scientific work in Mexico, he counseled against allowing the program to become deeply involved in the general application of its work to Mexico. The basis for determining the termination of the MAP was therefore based on establishing a set of rules for the improvement of agriculture and the departure of the Foundation before the social consequences of these rules became apparent:

For example, I can imagine that this program before long might begin to have a considerable impact upon the whole land-use policies of Mexico, and I am perfectly sure that within three to five years the program will raise some very acute problems with respect to the political control of these benefits . . . , these very benefits may introduce fresh economic disparities within the Mexican economy, which will present political problems not now even dimly perceived by many Mexicans.[31]

Dickey emphasized his example, saying, "It would be unfortunate for all concerned, especially for the program itself, if the Foundation is heavily in the picture when this [growth in social tensions] takes place." [32]

Dickey's concern, unlike that of Carl Sauer, was not to understand how to lessen or prevent the social consequences of changes in agricultural technology. Dickey's questions to Foundation members were how to conduct a program of agricultural innovation without jeopardizing the gains already achieved in Mexico and programs being planned elsewhere in the world. Dickey's analysis of the consequences of introducing new agricultural techniques and his subsequent counsel to the Foundation was for ways to limit its responsibility in the management of science. Instead of basing the Foundation's experiment in agriculture on the improvement of social conditions, as Sauer suggested, Dickey urged the Foundation to locate its responsibility in the validity of scientific experiments. Such an orientation contributed to the Foundation's support of a scientific community that isolated the evaluation of its activities to the measurement of changes in production. Dickey's limiting principle supported a scientific community that was divorced from any process that demanded of the scientists a critical reflection about the social value and consequences of their work in agriculture. The fact that Dickey regarded the MAP as a success and sought to replicate its activities in other parts of the world illustrated the Foundation's backing of a science that separated the theory from the practice of technological change. This division of theory and practice was not happenstance.

In spite of the fact that Warren Weaver and others were aware of Sauer's critical assessment of the Foundation's plan for agriculture, no attempts were made to consider Dr. Sauer's remarks. While Dickey's assessment also indicated the negative consequences of the Foundation's work in Mexican agriculture, his preoccupation was one of how to disguise the recognition of the political dimensions of scientific research as managed by the MAP. To this end the Foundation arranged for a study of how best to bring about changes in Mexican agriculture while keeping this remote from political discourse.

During the 1940s the Mexican Agricultural Program proceeded toward the goal of increased productivity without any further consideration about the social consequences of this enterprise. The anticipation of negative consequences only

signaled to the Foundation officers that it might be necessary to work more strenuously to limit notions of responsibility within the scientific community. This limitation illuminated a basic purpose in the Foundation's program of 'technical cooperation.' Technical assistance provided an ideal aegis for achieving political ends. In a 1950 communication delivered to Chester Barnard, the acting president of the Foundation, Warren Weaver spelled out the meaning of the experiment in Mexican agriculture.

First of all, Weaver noted the perversion contained in the reference to the Foundation's program as cooperative in nature.

We customarily refer to this program as a collaboration between the Mexican Government and the Rockefeller Foundation, this collaboration having been undertaken at the request of the Mexican Government. Although formally accurate, this statement is actually very misleading . . . it must be realistically admitted that they had little or no idea as to what we were talking about, or what we intended to do.[33]

Weaver further explained that the Foundation provided little opportunity for Mexicans to share in decisions as the joint program progressed:

First of all, if one takes into account the fact that this program was initially more or less stuffed down their throats, and that all of the money involved is spent under the complete control of North Americans, then it must be conceded that Mexico has in fact increased their contribution, year by year, in a rather surprising way.[34]

Most revealing of all, however, was Weaver's statement that the promise of increased food remained subsidiary to the Foundation's interest in a larger experiment in social engineering.

[Secondly], I do not think that it is proper for the RF to think of this activity as "Mexican" in the strict and limited sense that Mexico gets all of the benefits of it and should therefore pay a large fraction of the bill. Actually, it is something of an accident, from our point of view,

that this project happens to be located in Mexico. The Rockefeller Foundation wanted to try an experiment. Mexico offered a favorable location. In the first instance this project is going to produce more and better corn and beans for Mexicans; but from a much larger and important view, it is a basic experiment in international technical cooperation.[35]

Weaver, who for so long hoped to conduct an experiment for the rationalization of life, discovered an opportunity in the Mexican Agricultural Program. Although this experiment was not nearly so grand as the earlier proposals in psychobiology, the MAP did hold the promise of operating internationally.

Some of the social implications of this experiment will be pursued in later chapters. In the next chapter we will review the achievements of the MAP in its second decade, the 1950s, and begin to explore the social elements of the Foundation's work in Mexican agriculture.

CHAPTER III--NOTES

1. John A. Ferrell, memorandum to Raymond Fosdick (Tarrytown: Rockefeller Foundation Archives, October 16, 1936), 323/, p. 1.
2. Ibid.
3. For an example of one author who analyzes the Foundation's mission in these terms, see: Harry J. Cleaver, Jr., "The Origins of the Green Revolution," Ph.D. dissertation, Stanford University, Palo Alto, California, 1975.
4. Hiram M. Drache, "Midwest Agriculture: Changing with Technology," Agricultural History, Vol. 50 (No. 1: January 1976), p. 291.
5. Richard Lowitt, "Henry A. Wallace and the 1935 Purge in the Department of Agriculture," Agricultural History, Vol. 53 (No. 3, January 1979), p. 610.
6. Ibid., p. 619.
7. John A. Ferrell, memorandum of conference with Vice President Henry Wallace (Tarrytown: Rockefeller Foundation Archives, February 10, 1941), 1.2/323/1/2/, p. 2.
8. Ibid., p. 6.
9. E.C. Stakman, Richard Bradfield, and Paul Mangelsdorf, Campaigns Against Hunger (Cambridge: The Belknap Press of Harvard University, 1967).
10. Ibid., pp. 32-33.
11. Ibid., p. 22.
12. Ibid., p. 1.
13. E.C. Stakman, Richard Bradfield, and Paul Mangelsdorf, "Recommendations of the Commission to Survey Agriculture in Mexico" (Tarrytown: Rockefeller Foundation Archives, December 3, 1941), 1.2/323.
14. Ibid.
15. Carl O. Sauer, letter to the Rockefeller Foundation (Tarrytown: Rockefeller Foundation Archives, February 10, 1941), 1.2/323/, p. 2.
16. Ibid., p. 3.

17. Carl O. Sauer, letter to Joseph Willits (Tarrytown: Rockefeller Foundation Archives, February 12, 1945), 1.2/323, p. 1.
18. Ibid.
9. Ibid.
20. Ibid., p. 3.
21. Ibid.
22. Ibid., p. 1.
23. International Health Division Annual Report (New York: Rockefeller Foundation Archives, 1947), 1.2/323/, p. 96.
24. Ibid.
25. Anon., "Mexico Nutrition Studies Progress Report," International Health Division Annual Report (New York: Rockefeller Foundation Archives, 1944), p. 34.
26. Ibid.
27. Robert C. West, Carl Sauer's Fieldwork in Latin America (New York: University Microfilms International, 1979), pp. 113-114.
28. Paul Mangelsdorf, memorandum to Warren Weaver (Tarrytown: Rockefeller Foundation Archives, July 26, 1949).
29. Warren Weaver, memoranda to John S. Dickey, Thomas Parran, and William Meyers (Tarrytown: Rockefeller Foundation Archives, October 26, 1949), 1.2/323.
30. John S. Dickey, memoranda to Warren Weaver, William Meyers, Thomas Parran, and J. George Harrar (Tarrytown: Rockefeller Foundation Archives, January 1951), 1.2/323, p. 2.
31. Ibid., pp. 2-3.
32. Ibid.
33. Warren Weaver inter-office correspondence to Chester I. Barnard (Tarrytown: Rockefeller Foundation Archives, September 21, 1950), p. 1.
34. Ibid., pp. 2-3.
35. Ibid., p. 3.

The Transformation of Mexican Agriculture, 1950-1960

A distinguishing trait of the techniques introduced by U.S. agricultural scientists to Mexico in the 1940s and 1950s was the image of neutrality. While local scientists argued the merits of agrarian reform, Foundation supported scientists limited their activity to experimental plots. In histories reconstructed by the participants and contained in texts written by professionals in the field, the decisions of this epoch are characterized as the spread of scientific rules of observation and technique.[1] The Mexican Agricultural Program (MAP), for instance, published numerous reports during the 1950s that described choices as discrete and limited.[2] Various authors located their work in a landscape that appeared problematic only in terms of best suited crops, maximum yields, and techniques of production.

Such a language distorted the impact that U.S. scientists had in Mexico. Landscapes in twentieth century Mexico held not just soil, plants, and farms, but people. While this distinction may at first glance appear trivial, this language reflects a body of research that purged consequences from first professional, and eventually public, discourse. In place of a science bound to its subjects, i.e., farmers, U.S. scientists responded to 'opportunities.' While research opportunities appeared determined by physical attributes, a closer examination revealed them to be considerations that were economic and class bound. This was a science in service to capitalist agriculture.

Describing work in terms of adjusting physical factors for increased production functioned as an important source of legitimacy for U.S. scientists. When MAP scientists moved through the countryside they identified opportunities in terms of the physical environment: access to regular

irrigation, the control of nutrients, the elimination of disease, and the design of plants. This clinical language of the laboratory disguised and made remote the social meaning of their tasks in farmers' fields.

This does not mean that Foundation scientists remained oblivious to the social context. The events of the 1950s demonstrated that in many important respects scientists saw questionable consequences in their work. Yet these questions were always limited to a particular project, a certain locale, or specific individuals. There is no evidence that scientists questioned relationships between their work and consequences. The idea that research as constructed in the United States and reconstructed in Mexico might produce contradictory relations between private ends (e.g., capital) and public ones (e.g., food) did not seem possible. Even if particular farmers, those willing to take 'risks,' gained disproportionately in the spread of techniques, other members of society still gained by cheaper foods.

In this chapter we will begin to explore the emerging contradiction between the demands for food and capital. The record of the 1950s will demonstrate that as MAP scientists restructured agriculture in Mexico, the link between increased production and food grew more tenuous. While this is explored in greater detail in a subsequent chapter, this contradiction is located in the expansion of MAP authority in the 1950s.

A related and vital aspect of the MAP in the 1950s is the spread of 'science' as a basis of political authority. At the same time that the neutral language of science legitimized the transformation of agriculture, this also became a tool for the rearrangement of power. As we will see, those who attempted to challenge the directives of MAP scientists confronted a seemingly neutral agenda. How could politicians argue against applications of the science of plants, soil, animals, and so on?

The substance of this chapter examines the link between science and capital in Mexico, the experiment station. The most important of these stations were: El Horno, located near Chapingo in the state of Mexico; La Cal Grande, situated in the state of Guanajuato and later moved to El Roque; Ciudad Obregon in Sonora; and La Campana, Chihuahua. In a narrow sense these stations provided for the expanded productivity in selected crops. From a wider perspective these

stations served as important points for the forging of new political and economic relations both inside and outside Mexico.

A basis of changed political relations occurred in the MAP's work with producer associations, or patronatos. More than simply responding to these groups, the Foundation and its scientists actively participated in creating these groups. As the Foundation transferred authority over experiment stations to these groups confrontations occurred between itself and the older community of agricultural scientists in Mexico, the Institute of Agricultural Investigations (IIA). At stake were not simply relations between the state and local capital, but the interest of U.S. based agribusiness firms beginning to operate in Mexico. The MAP scientists occupied, therefore, a crucial role in the transformation of Mexican agriculture. Without simply taking 'orders' from the Rockefeller Foundation, MAP scientists tacitly approved the connection--science and capitalism--that represented the basis for their work in Mexico.

In conversations between Ed Wellhausen and George W. Gray in 1952, for example, we see that the success of MAP extension occurred among those who practiced farming as a means of accumulating capital:

GWG: This ranch that we were at the other day, that Mr. Spurlock is running, is that representative of a lot of big holdings?

EJW: Well, of course, the good seed is first reaching the farmers such as Mr. Spurlock. What we call the small property-holders. Some of those properties are not so small; they may be two or three hundred hectares of land; but they are primarily the remnants of the old haciendas, which had twenty-five thousand hectares . . . They have come to us and they have asked for the seed, and they have invited us to demonstrate on their farms, and so on. As a matter of fact, it was through that group that we were able to make as much progress as we have.[3]

At the same meeting where farmers such as Mr. Spurlock received praise, Dr. Wellhausen described the common farmer as a problem. Ed Wellhausen told how a farmer had cultivated a very good rice crop, but used only half of his land.

Wellhausen asked why the farmer did not cultivate all of his land:

farmer: I got enough, I don't need any more.

EJW: Well, why don't you sell it?

farmer: Sell it? Sell it? Why, then I'd have to work to cut it, and thrash it, and I wouldn't get anything for it, because somebody'd come around, and want to give me a little bit, and want me to give it to him for nothing. No. I got enough, I don't need any more. I'll plant some more next year--that's enough for my own use.[4]

Wellhausen concluded that the story portrayed a basic problem with many of Mexico's farmers.

You see, they aren't thinking in commercial terms. They're thinking in the terms that they thought thousands of years ago, when everybody lived from hand to mouth and made everything that they used. That philosophy, of course, is changing very rapidly, but it's still prevalent among these farmers.[5]

The problem, moreover, did not occur in terms of relations between the farmer and his soil, plants, or physical environment. Rather, it involved relations between cultivation practices and the market. The millions of subsistence farmers therefore constituted a dual problem in the eyes of Dr. Wellhausen: first of all they did not seek to maximize production; second, they did not market their produce in commercial terms equivalent to farmers in the United States. MAP scientists now inserted themselves in a problem that went beyond the conventional bounds of natural science.

If the MAP scientists' commitment to commercialized agriculture placed it on an antagonistic footing with campesinos, its relations with the politically powerful was not always harmonious either. Although the Foundation and its scientists preferred to have public policies and commercial interests complement one another, competent research originated from an economic logic. From this perspective, attempts to subordinate research to either parochial political interests or campesinos appeared equally disagreeable.

In the early 1950s Drs. Harrar, Wellhausen, and associates initiated an effort to organize a system of

agricultural experiment stations at several locations of traditionally commercialized agriculture. The research agenda at each of these stations began with the initiative of U.S. agricultural scientists; eventually the research centers were "controlled by a board of directors made up of leading progressive citizens of the region." [6] Before MAP scientists realized this structure of research it would be necessary to defeat the community of indigenous scientists who attempted to redirect the social control of research to the campesino. The eventual defeat of this other community contained consequences for the food production system, the class control of research, and alternative agricultural research. We must now examine those experiment stations and the reorganization of Mexican agricultural research.

Experiment Stations: The Class Control of Research

El Horno: Maize

The Rockefeller Foundation established its first experiment station, named the El Horno, at Chapingo. El Horno represented the most important center for research pertaining to the diets and farming practices of Mexico's population. As an early administrative center for the MAP, El Horno offered U.S. agricultural scientists a ready opportunity to reform the production of millions of subsistence agriculturalists.

During the early years of the maize investigations, Dr. Wellhausen and associates collected over two thousand different strains of native corn varieties in Mexico, Central America, and the Caribbean. In Mexico, Dr. Wellhausen identified sixteen native varieties that possessed superior yield characteristics. Among these, the MAP propagated six varieties for distribution to farmers during the 1940s.

In addition to their experimental work, Foundation scientists persuaded the Mexican government to construct in 1948 a national seed production and distribution agency, PRONASE. PRONASE, following the lead of U.S. agriculture, emphasized the spread of hybrid maize. While hybrid research promised greatly increased yields per unit of land, the requisites often precluded its use by most agriculturalists.[7]

Partly in response to the inability of many farmers to purchase new seed each season, as required with hybrids, the

MAP program developed improved corn varieties and synthetics. With synthetics Wellhausen and associates enabled farmers to plant improved seed from previous crops. The productivity of hybrids, in contrast, often decreased if farmers used seed from a past harvest to start a new crop. Initial population improvements of maize by the MAP contained characteristics valued by many peasant agriculturalists, such as greater forage material (for feed) and prolificacy (greater number of ears per plant). However, even these improved populations often possessed traits that nullified their potential benefits to subsistence producers. One of the celebrated synthetics, ROCAMEX V-7, was described in a 1948 MAP publication as limited to those farmers "having irrigation facilities or in areas in which the reserve moisture from the previous rainy season is sufficient for germination." [8]

While the MAP expended considerable sums on maize research during the 1940s and 1950s, the effects on production at the national level remained minimal. By 1950 the improved maize materials developed by MAP scientists accounted for no more than 8 percent of national production. Indeed, a World Bank publication authored by Dr. Theodore Schultz, disputed this minimal success, stating that of the 58 percent increase in corn production between 1939 and 1950 less than 2 percent came from hybrid seed. [9]

In spite of the lack of widespread adoption, improved maize produced high yields on those farms with sufficient capitalization to conform to planting dates, spacing, watering, fertilizing, and other specifications. Generally, however, the Mexican Agricultural Program assigned a low priority to the improved cultivation of maize. Under the direction of George Harrar, the MAP promoted maize as a cattle feed and industrial grain. [10] At the same time U.S. agricultural scientists ignored the traditional practice of intercropping maize with beans, promoting monoculture instead. This orientation, while it fostered the development of commercial agriculture, conflicted with the conventional farming practiced by millions of cultivators.

With the change in presidential administrations from Miguel Aleman to Rodolfo Ruiz Cortinez in 1952 the new Minister of Agriculture, Flores Munoz, challenged the research agenda set by MAP scientists. Stating that the republic faced an urgent need to expand maize production, the Minister placed the MAP and its Office of Special Studies under his direct control. While the differences between the MAP and Minister Munoz appeared as a bureaucratic test of wills,

the substantive differences were rooted in the expression of class interest in the work of U.S. agricultural scientists.

In a general statement to the Foundation, Harrar explained the problem that Munoz posed to MAP operations:

Because of the insistence of the Minister that everything must channel through himself or his associates, there has been some weakening in the earlier and rather successful movement to strengthen state agricultural operations. Minister Flores Munoz has had some success in overcoming the tendency to decentralize agricultural activities (which the MAP originally stimulated) and is attempting to centralize all agricultural authority within his office . . . The Minister is also opposed to patronatos, or farmers' associations designed to support local agriculture with facilities, money, and political advantages . . . This philosophy of centralization by the Minister has of course made it impossible for the OEE to be as freely helpful to state efforts as was formerly the case. [11]

The cause for alarm among Harrar and others arose, in addition, to problem with Minister Munoz, from the administration of President Cortinez. In communications between New York and Mexico City one Foundation officer reflected the distrust with which the MAP regarded the new administration in terms of its link with Lazaro Cardenas:

There are rumors running around that the R.F. will have a new convenio and one story (repeated several times) was that the suggestion had been made that the RF turn over their funds to the government for them to administer. Ed Heilinger told me at lunch today that Tom Miller (the very rich American in Coyocan) says that he is selling all his property because he thinks the present regime is going pretty far left. He says that Cardenas is directing Ruiz Cortinez. [12]

By the next day Ed Wellhausen and George Harrar communicated to Warren Weaver that Flores Munoz had demanded that "the Office of Special Studies drop almost anything else that they are doing and throw all of their personnel and their

resources into the support of his extension program." [13] The argument about the promotion of extensive maize cultivation, however, encompassed a much more profound debate about the purpose of agricultural research in Mexico.

The dispute over what represented an appropriate research agenda did not involve merely scientists on one side and an aspiring politician on the other. This debate also included other scientists attached to another research branch of the Ministry of Agriculture, the IIA. Indeed, one of the major substantive issues that divided the IIA and the OEE (Oficina de Estudios Especiales) stemmed from a difference over maize research. The Rockefeller Foundation referred to the Agricultural Mission by several names: Mexican Agricultural Program (MAP), Office of Special Studies (OSS), and Oficina de Estudios Especiales (OEE). The IIA addressed this difference in its 1955 report:

Since irrigated corn accounts for only 5.3 percent of the area sown annually, if yields are increased 50 percent only in irrigated regions, total production will only increase 5 percent. The best possibility for raising output is to be found in a modest increase in the yield per hectare [of corn] in the non-irrigated regions which constitute 94.7 percent of the total sown area. [14]

The modest increase that scientists in the IIA argued for entailed, however, a different commitment from the Foundation's agricultural scientists. Instead of adopting procedures to identify maximum increases in productivity in maize, MAP scientists would have to examine more extensive factors affecting harvests.

At the level of research the IIA promoted investigations of improved varieties. These varieties, while lacking the yield potential of hybrids, were adopted by a vast number of common agriculturalists. [15] As early as 1952 scientists with the IIA had advocated the need to emphasize improved varieties over hybrids:

"Although they are somewhat less productive than the hybrids, they have the great advantage of permanence, and the farmer can use a part of his harvest for seed the following year exactly as our small cultivators are accustomed to do when they plant." [16]

A rationale for the reorganization of Mexican agricultural extension, according to the Minister, resulted from an anticipated short-fall in the supply of maize. The Minister issued orders that the Ministry increase maize production by 58 percent in 1953. [17] The MAP staff viewed the demand to subordinate other research, especially commercial, to increased maize production as the invention of a great disaster meant to gather political support. Yet in 1952 Ed Wellhausen acknowledged that a general scarcity of maize existed that brought with it a rather dramatic increase in prices of this staple in rural areas. [18] Nevertheless, Wellhausen forecasted surpluses and lower prices. In 1953 MAP scientists continued to dismiss the claims of inadequate production as a myth.

Yet official statistics support the contention that as a food source for campesinos, maize prices reflected a condition of scarcity. The fact that MAP scientists took little or no immediate action to aid rural peoples' need for this important foodstuff resulted, at least in part, from different objectives in the structuring of agricultural production. In terms of productivity, from 1953 onward maize achieved yields unmatched both in terms of per hectare yields and aggregate total production. [19] At the same time, however, record levels of imports flowed into Mexico. In fact, during the years 1953 to 1957 Mexico imported more than twice the combined total imports for the previous thirty years. [20] Whatever the disposition of the record levels of production and imports, the volumes of grain had little impact on consumer prices. Between 1953 and 1957 the average rural price for a kilogram of maize increased by 40 percent according to statistics that very well under-reported the actual climb in prices. [21] The major concern of the MAP rested not with the public health of Mexicans, but maintaining control over research agendas.

In response to Minister Munoz's demand, George Harrar and Warren Weaver immediately agreed that Dean Rusk must travel to Mexico, meet with President Cortinez and obtain "a strong reaffirmation of the autonomy of our activity in Mexico." [22] Drs. Harrar and Weaver further agreed that unless such a commitment were forthcoming, "then it would be the tragic fact that we would have no alternative but to diminish our activities or to withdraw." [23]

President Rusk, of the Rockefeller Foundation, visited Mexico and secured President Cortinez's commitment to MAP autonomy. By 1954 Dr. Harrar and associates managed to

overtake Flores Munoz through the professional corps of Mexicans trained in the Office of Special Studies. Dr. Harrar explained this to the Foundation in a 1954 memo:

Perhaps the most heartening thing about the extension service is the fact that all of the key personnel have had some training within the MAP . . . This not only provides a demonstration as to the value of the earlier association with the OEE, but because of their personal loyalties assures that they will visit the Office with all possible frequency and will continue to collaborate in the field and call upon the Office for help in the development of their respective field programs in areas under their jurisdiction.[24]

The triumph of U.S. agricultural scientists over their Mexican counterparts marked the eclipse of the IIA by a Rockefeller transplant--the Mexican Agricultural Program. One consequence soon to follow this victory resulted with placing greater resources at the disposition of fewer farmers. By 1956 the Ministry of Agriculture allocated 96 percent of its seed producing capacity for the production of hybrids, an input little suited to the farming conditions faced by millions of agriculturalists. A later review panel commissioned by the Foundation noted the skewed utilization of hybrids, while blaming farmers for their 'unwillingness':

During 1947-66 more than twenty hybrids were released by the Mexican government. . . . By 1966, the use of hybrids in Mexico reached no more than 10% of the private maize fields, clearly because of the lack of an effective production and distribution system for hybrid seed, and the unwillingness of many farmers to replace their seed each year, at relatively higher cost.[25]

The reviewers failed to note that the decision to research as well as the system of production and distribution of hybrids was largely the result of MAP scientists, not the Mexican government.

Another immediate consequence to follow from the MAP's increased autonomy included investigations of crops other than food important in Mexican diets. In fact, in the 1950s a large part of the budget destined for maize went toward the promotion of sorghum. The decision to expand the

production of sorghum promised benefits to the Mexican public even more dubious than that of hybrid maize.

La Cal Grande: Sorghum and Barley

By 1948 the Mexican Agricultural Program established a second experimental research station in the Bajio--one of the great agricultural regions of Mexico that included portions of the states of Michoacan, Jalisco, Queretaro, and Guanajuato. Initial experimentation was quickly expanded to include other cereal grains. By the close of the 1950s the main research station in the Bajio played a catalytic role in the spread of sorghum and barley as major crops in the region.

One of the first research objectives to appear on the agenda for work at La Cal Grande began with sorghum. In 1948 Dr. Harrar arranged for experimental trials with sorghum. The test conditions in addition to taking place in the relatively temperate climate of the Bajio also had a plentiful supply of irrigation water. Although sorghum represented a potential contribution to resource poor farmers, the MAP conditioned test materials on resource rich environments. Such experimental conditions supplied scientists with little information about the utility of these sorghum materials in either the climate or conditions under which most of Mexico's agriculturalists labored.

One of the major flaws connected with the MAP's promotion of sorghum had little to do with experimental conditions. The major problem in the spread of sorghum derived from the fact that it did not represent a direct consumer food item for Mexicans. In a 1951 study commissioned by the Rockefeller Foundation, Dr. Herrell De Graff reported this fact:

Yet the opportunities in Mexican livestock farming are great. The work which Dr. Pitner of the DNSA staff has done with sorghum grains holds great promise. To a much greater degree than corn, sorghum is a dry land crop . . . Sorghum is not accepted as a food grain in Mexico and therefore is available for feed. I shall be surprised if the land area devoted to sorghums in Mexico does not greatly expand as a result of Dr. Pitner's work. A corresponding increase in the production of grain consuming livestock will be possible and highly desirable.[26]

The fact that sorghum represented a source of feed for increased animal production offered little consolation to most Mexicans because of the prohibitive price of these goods. Even Dr. De Graff acknowledged that animal-source foods had little place in the diets of low income Mexicans.[27]

In spite of the dubious link that sorghum held in the diet of most Mexicans, by 1959 the Mexican Agricultural Program supplied even greater stimulus to increased sorghum production with the relocation of its research in the Bajio. In moving the station from Irapuato to El Roque, Guanajuato, the Foundation now coordinated sorghum with cattle production.[28] At the same time that the research sites were moved, scientists met with the local livestockmen's association to determine research needs.

As late as 1963 the Foundation participated in the promotion of sorghum production by providing a full-time researcher, Clyde M. Christensen.[29] By the early 1960s sorghum expanded dramatically, largely because of its application to feedlots in Mexico. Recent investigations revealed that as sorghum production increased in certain regions, the cultivation of corn decreased. One study conducted in the Bajio between 1967 and 1977 compared a decrease in maize from 35 to 6 percent of total cultivated area, while sorghum grew from 9 to 51 percent.[30] Another study provided similar findings describing the inverse relation between sorghum and maize cultivation, while noting the lower production costs associated with sorghum.[31]

The lower costs of sorghum production cannot, however, be separated from an understanding of demand. The demand for sorghum occurred specifically in terms of animal feed, particularly in hog and poultry production. Once again, the MAP scientists actively encouraged these uses of sorghum with the assumption that this provided a cheaper and more efficient means for producing quality (i.e., high protein) foods.

As late as the early 1980s, however, chicken, pork, and eggs represented foods often absent in diets of average Mexicans.[32] In addition to those outside of the MAP, even its own animal scientist questioned the wisdom of fostering competition for grains through the expansion of animal production in the 1950s.[33] At the same time that the Foundation expanded agricultural production in Mexico, it structured utilization according to a logic of profit, not

consumption. This maxim is demonstrated in yet another commodity subject to MAP research in the Bajio, barley.

Prior to the arrival of the Mexican Agricultural Program, barley occupied a small position in agricultural production. In the early 1930s production averaged roughly 70,000 tons. By the early 1940s production increased gradually to approximately 115,000 tons in 1945.[34] In addition to increased production, the uses of barley changed over time. In the early 1930s, for example, about 4 percent of barley went toward the production of malts, probably for beer.[35] Of the balance, the livestock industry used about 65 percent with probably no more than 10 percent consumed directly by the populace. Barley played an insignificant part in diets generally and therefore commanded little in harvested areas.

In spite of the small public demand for barley, in the 1950s MAP researchers conducted a variety of tests with this crop. The impetus for barley research began with the Mexican Association of Malsters and their representative, Mr. Zeigler. E.C. Stakman, Ed Wellhausen, Norman Borlaug, and John Gibson quickly established the Association's interest as their own.

By 1954, however, with complications brought on by Minister Munoz, Dr. Harrar called a halt to barley research. In March 1954, George Harrar wrote Ed Wellhausen, "Our present situation in Mexico is one which we think is delicately enough balanced that we do not want to throw any weight in what might be the wrong direction." [36] Research on a commodity that not only had limited public benefits but received stimulus from private corporations might well jeopardize the MAP's attempt to maintain autonomy with the guise of scientific objectivity.

The malting corporations did not limit their expression of disappointment to Mr. Zeigler's protest that "he and his associates were convinced that their only hope was the OEE." [37] Within two weeks of Dr. Harrar's decision to suspend research on barley, Dr. J.G. Dickson with the Department of Plant Pathology at the University of Wisconsin wrote to John Gibler at the Rockefeller Foundation. Dr. Dickson contended that barley represented an important foodstuff mentioning its use in bread and food grains; he also noted that it did not suffer the magnitude of losses that other grains often did to plant pathogens.[38]

Yet even Dr. Dickson's arguments regarding barley as a food source suggested that its most valued uses occurred in

non-food or luxury food items. In its most publicly useful form, as a substitute for bread wheats, Dickson cited the interest of only one maltster in terms of bakery applications. Dickson described barley's major role in beer, feed grains, processed foods, and pharmaceuticals. In closing his letter to the Foundation, Dickson stated, "The barley program in the United States can profit by the cooperation with a similar program in Mexico on the same basis and to the same extent as is being realized in the wheat program." [39]

While George Harrar remained steadfast in suspending barley research, he did supply Zeigler with a strategy for placing barley on the Ministry's research agenda. Harrar suggested that if someone approached the Sub-Secretary of Animal Husbandry, a close associate with MAP scientists, that Minister Munoz might be convinced of the need for Foundation participation.

Following the Foundation's decision to suspend research on barley, Dr. Warren Weaver delivered a paper to the Malting Barley Improvement Association at Milwaukee, Wisconsin. [40] Among those attending the conference were representatives of: Anheuser Busch, Fleishman Malting Company, Pabst Brewing, Joseph Schlitz Brewing, Archer Daniels Midland, Bunge Corporation, Cargill, and Pillsbury. [41] While there is no record that Dr. Weaver promoted specific research requested by these companies, within two years research sought by the malting interests in Mexico was resumed. [42]

In early 1957 Wellhausen communicated to Harrar a request by Sub-Secretary Ricardo Acosta for the MAP to continue barley research in cooperation with the Mexican Association of Malsters. [43] What is more, the cooperative research limited work to two objectives: the production of barley varieties for malting and feed grain purposes. [44] Not only did barley research proceed without reference to its other food source applications, the experimental design provided no evidence of how improved varieties might fare under marginal conditions, in spite of the crop's potential for such environments. By 1958 the MAP reported successful barley materials existed for adequately irrigated fields and possessed characteristics for direct combine harvesting. [45]

The emphasis that MAP scientists placed on the cultivation of sorghum and barley fitted, moreover into another facet of research and development. While both of these grains were touted with respect to yield potentials that exceeded corn, MAP scientists also recognized the improved

applications of these as feed grains. During the late 1950s Foundation scientists worked extensively toward the integration of livestock and feed production. It is particularly the livestock/feed complex that had most important consequences for Mexico's food production system.

La Campana and El Roque: Livestock and Feed Grains

Although the Mexican government did not initially assign a high priority to the livestock industry, soon after the establishment of the Mexican Agricultural Program the Rockefeller Foundation urged its expansion. In July 1944 the Secretaries of Agriculture for the United States and Mexico, Mr. Wickard and Merte R. Gomez, agreed to create the Mexican-United States Agricultural Commission. The purpose of the commission, stated to be mutual, resulted especially from the interest by the United States to have a sure supply of foodstuffs from Mexico, including beef, to support the war effort.

Dr. Harrar, as a member of the Commission, served on subcommittees concerned with crop and livestock improvement. Harrar noted that the main issue of livestock involved border quarantine: "Since the livestock industry is of paramount importance in northern Mexico and since 90 percent of the cattle produced in this section are sold in the United States, an immediate problem arose and there has been great interest in having the quarantine lifted." [46] Dr. Harrar's interest in the Mexican livestock industry transcended temporal wartime exigencies and encompassed long-range plans.

In 1946 Harrar wrote to Paul Manglesdorf of his intention to integrate crop research with the needs of the livestock producers. He identified range development/management and feed production as areas of significant potential agricultural development. In addition to research on forage grasses as used in pasturing, Harrar also specified work on legumes and cereals as necessary for the development of the livestock industry. In spite of the importance assigned by Harrar to livestock improvement, the MAP made little headway during the 1940s.

In 1951 the Foundation's interest in the Mexican livestock industry received renewed support in a report submitted by Dr. Herrell De Graff, a consultant to the Foundation's Social Science Division. Among a number of proposals and assessments made in De Graff's report appeared his

encouragement that the Foundation provide greater stimulus for research in support of an enlarged feed grain/cattle complex:

I think there is an opportunity and a challenge here for a farm-management specialist to contribute to the development of a more profitable, more permanent combined crop and livestock agriculture. I think further that as the Foundation's contributions to Mexican agriculture are widely adopted some very important changes in livestock will follow.[47]

Yet, even as De Graff advocated this "sharply changed farm organization" as "highly desirable," he also noted two attendant changes that undercut the notion of supposed public benefits.

First of all, De Graff noted that changes in production of cattle also affected the allocation of cereal grains. Herrell explained that with the enlargement of animal production, both corn and wheat could be used as either feed or food grains. He then argued that in all likelihood greater amounts of these cereal grains would go for feed grains. Secondly, he speculated on a critically important issue related to this prior observation: what impact did he expect the proposed feed/cereal complex to have on typical diets? De Graff gave little reason to believe that expanded cattle production would make any changes in the households of many, let alone most, Mexicans:

Even so, any animal-source foods are notably lacking in the diets of rural and low-income urban Mexicans. The relative cost of these foods compared to corn and beans is too great for them to be used in any appreciable quantity by families with incomes of 40 cents to a dollar a day.[48]

These two observations provided a compelling basis for a further examination and more reasoned consideration of social and economic consequences before proceeding toward the proposed feed grain/ livestock complex. There appeared, however, no evidence that either officers of the Rockefeller Foundation or agricultural scientists working in Mexico paused to reflect on such matters.

The MAP's work in livestock advanced slowly. In the 1950s MAP personnel, like Dr. Pitner, contributed to research on animal feeds, but a forage crop program did not result until 1953.[49] And while scientists established a poultry project in 1955, the MAP by then still lacked effort to organize livestock production.

In 1956 during a policy session of MAP scientists part of the discussion centered on the question of livestock production. Dr. Meyers opened the meeting, indicating that one possible advantage of livestock production derived from the use of feeds not otherwise available for human consumption.[50] Dr. Wellhausen supported this point, stating that only cattle could utilize half of the country's land area.[51]

Dr. Pino, responsible thus far for the MAP's poultry project, questioned the wisdom of increased livestock production for Mexico. Pino noted that if the MAP objective came from a commitment to improved diet, the injection of animals between plants and man might well be seen as the inefficient use of grains. He viewed the expansion, stating: "At present, however, poultry is competing for grains, and there is a real question as to whether this is sound in Mexico." [52]

Indeed, even Norman Borlaug hesitated to give support to the MAP's work on livestock. Ironically, Borlaug explained the negative ecological consequences that already occurred with erosion due to over-grazing. Dr. Borlaug suggested that instead of livestock, the Foundation might consider giving encouragement to the forestation of these areas. Borlaug identified land-use as a major concern for Mexican agricultural during the next twenty years.[53]

In spite of the problems inherent in the livestock industry, by 1956 Drs. Buller and Pino worked with one of the largest and most powerful associations of livestock producers in the country, the Livestock Union of Chihuahua.[54] By 1958 the MAP had established a livestock research station at La Campana, Chihuahua, with extensive pastures and funding provided by the Livestock Union. In 1959 the MAP also arranged for the transfer of the La Cal Grande station to El Roque. The move represented yet another agreement by MAP scientists to bring the feed grain/livestock complex to fruition.

By 1959 the Rockefeller Foundation decided as one of its last efforts in guiding the course of Mexican agriculture to develop the livestock and poultry industries. This objective entailed not only the promotion of greater numbers of animals, but the encouragement of a complementary feed grain industry in regions previously dedicated to food grain production. Kenneth L. Turk, acting as consultant for the Foundation, traveled to Mexico in 1959 for "the development of plans for an expanded research program in the animal sciences in Mexico." [55] Drs. Pino and Buller devised his travel plans in conjunction with Ralph Richardson's advice that highest priority be accorded the investigation of potentials for livestock production in the Bajio.

In August and September of that year Turk spoke with numerous people engaged in animal production throughout Mexico. These included faculty members from Chapingo and Monterrey, officials with state and federal offices of agriculture, various MAP scientists, representatives of livestock organizations, owners of large cattle and poultry production operations, and managers of milk processing and feed grain plants. This group of people comprised those Kenneth Turk believed to have interests necessary to understand the essentials of an expanded research program in the animal sciences. A brief summary of the information selected from the social context by Dr. Turk illustrates the subtle political dimension of his research.

Turk began his visit to two of the MAP's experiment stations at El Roque, Guanajuato, and Santa Elena, Mexico. The station at El Roque, as previously mentioned, fostered the livestock/feed grain industries in the Bajio, while work at Santa Elena emphasized poultry and feed production. Later in his visit, Turk also traveled to the livestock experiment station at La Campana. [56]

Accompanying these visits to centers of experimental research, Dr. Turk contacted the progressive farmers, livestock unions, and patronatos with whom MAP scientists had worked over the years. At Santa Elena this included "a large, commercial swine farm and a large dairy farm." [57] At El Roque, Turk spoke with members of the local livestockmen's association and later members of a dairymen's union in the region. [58] At La Campana he visited the office of the Cattlemen's Union. [59] At each of these sites and at points between, Dr. Turk often stopped to examine and speak with agriculturalists possessing large amounts of land and/or livestock. Following the pattern of research first practiced

by Seaman Knapp and later MAP scientists, he identified research needs of wealthy agriculturalists as the basis for determining the content and direction of research in the animal sciences in Mexico.

In his report to the Foundation, Dr. Turk did not limit the development of the animal sciences to only those large family farms; he also advocated a central and complementary role for corporate processors. At Queretaro, in the region of the El Roque station, Turk met with managers of a milk production plant owned by the Carnation Company. [60] Kenneth noted that work with the company would help in the development of a dairy industry in the Bajio and reported that the managers looked forward to "the possibility of a dairy research station in the Bajio region." [61] He also met with the managers of a feed processing plant owned by Ralston Purina located in Queretaro. [62] Ralston Purina represented, according to Turk, "a very high quality organization and by manufacturing and marketing quality feeds can contribute greatly to the poultry and livestock industry." [63]

The fact that farmers reported criticisms about practices by both of these corporations to Dr. Turk seemed to play little import in his report to the Foundation. In the case of Carnation, farmers told of variable milk prices paid by the company. This practice apparently resulted in the watering down of milk sold to the company from time to time. [64] At Ralston Purina the criticisms went unresearched by Dr. Turk, but probably related to a problem soon endemic with the spread of contract farming in the Bajio--"to sell a complete feeding and management program rather than just a bag of feed." This practice often resulted in furthering corporate control of farming in the Bajio while indebting farmers unable to follow the specifications in production contracts. Dr. Turk provided no recommendation that these criticisms merited further attention by either the Foundation of agricultural scientists. Rather, by virtue of research orientations practiced by MAP scientists and encouraged by Turk, the Mexican Agricultural Program worked against designing production according to different class interests.

Criticisms of Carnation and Ralston Purina appeared in Turk's report only insofar as these had bearing on the development of the livestock/poultry industry. Farmers angry with these corporations represented a problem to be solved through cooperation with these corporate agribusinesses. Turk, Richardson, and colleagues predicated their decision

to construct an expanded livestock industry in the Bajio on a collection of large farms linked to multinational corporations. Dr. Turk dismissed alternatives to this arrangement.

In conversations with the Director for Poultry Production in the Ministry of Agriculture, for example, Dr. Enrique Basanez told of a plan to create a diffuse poultry industry. The plan involved the formation of poultry stations at military barracks, jails, orphanages, and schools. Such a plan offered a potentially cheap solution for providing eggs and chickens to consumers who typically lacked both. Turk, however, withdrew support from the proposal, stating: "Such procedures are not likely to have a favorable effect on the poultry industry of the country." [66] During a meeting with another official at the Ministry of Agriculture, the Director of Livestock Development, Dr. Temblador, announced plans to increase cattle and poultry in each of the ejido districts in the Tlaxcala area. Once again the proposal included small numbers of cows, sows, and hens to be distributed among those collective farm units. Dr. Turk responded negatively to this idea as well: "While such a procedure may be temporarily helpful in providing animal products to these people, it is not likely to contribute much to the overall development of livestock in Mexico." [67]

Dr. Turk's report to the Foundation consisted largely of a review of (1) the potential in different regions for livestock and feed production, and (2) the ability of different producer organizations and corporate processors in these regions to expand production. Turk concurred with Richardson and called for measures to expand livestock and poultry production, especially in the Bajio among highly capitalized farm units and corporate processors.

As a means of promoting this agenda, Kenneth Turk advised the Foundation's mission in Mexico to use research as a catalyst for the livestock/feed industries. The MAP already had a mechanism, the National Center for Livestock Investigations (NCLI) (Centro Nacional de Investigaciones Pecuarías) that it had convinced the Ministry to create in 1955. [68] Turk urged that the MAP further its research on forage crops, animal nutrition, and feed grains and apply these through agricultural extension.

In the closing years of the MAP, the Foundation promoted and coordinated activities by John Pino (animal sciences), K.O. Ratchie (feed crops), and Roderic Buller (forage crops) through the NCLI, experimental research in the Bajio,

and other governmental agencies. By the early 1960s large commercial feedlots operated in the various regions where the MAP scientists had laid the basis through research on crops and livestock. In spite of the tremendous resources and research committed to livestock production, by 1980 such items as eggs, pork, and beef remained luxury goods beyond the reach of most Mexican consumers. [69] In addition to being directed toward export markets, the feedgrain/livestock complex constituted an important source of competition for other food grains as well. According to recent reports, the tremendous growth in livestock industry since 1960 has resulted in redirecting certain food grains, particularly corn, to feedlots from time to time. [70]

While others have criticized the situation in which Mexican agriculture has moved away from foods that sustain peasants and toward foods produced for wage earners or export markets, these studies have dealt with this movement as a product of national and international capital. Without disagreeing, these explanations lack an analysis of those who have rationalized this system of production--the agricultural scientists. In the case of the Mexican feedgrain/livestock complex it is especially those MAP scientists who constructed a population boom in cattle rivaling that of humans. "In other words, the livestock population now requires for its maintenance, in addition to its permanent pastures and to considerable feed imports, some 19 million acres of arable land, which is nearly as much as the entire area dedicated to corn and beans." [71]

Ciudad Obregon: Wheat

Wheat, first introduced by the Spaniards in the sixteenth century, by the 1940s still did not represent an important staple in the diets of most Mexicans. In an assessment of Mexican agriculture conducted by U.S. officials in 1948, they identified wheat as "an important food in the middle and upper income groups." These officials also noted the consumption of wheat as confined to urban populations. [72] Why then did MAP scientists select wheat as a major part of their work?

For Drs. Harrar, Stakman, and associates the Mexican wheat industry represented an immediate need in the early 1940s with which to support wars in Europe and the Pacific. With the end of World War II research on Mexican wheats continued because of its importance as a source of pathogens.

The ability to monitor and control pathogens that originated in Mexico and Central America amounted to a savings of millions of dollars for wheat producers in the United States and Canada.

In addition, the potential for cultivating and marketing wheat in Mexico remained largely unexplored. If traditional foods, particularly corn, could be replaced with the consumption of bread wheats a basis would be provided for the expansion of numerous agricultural industries ranging from capitalized inputs for producers to milling and baking equipment with processors. Discussions and written records by MAP scientists reveal that the market potential for wheat, and not its nutritive or household economic contributions, were primary concerns.[73]

During the early 1940s the Mexican Agricultural Program conducted tests with wheats in Mexico. The initial tests focused on wheats with rust resistance as a primary objective because of its significance in terms of yield. Although central Mexico had been a traditional area of wheat cultivation, the Mexican Agricultural Program quickly promoted its cultivation in areas in the Pacific Northwest, especially in the region surrounding Ciudad Obregon, Sonora. In addition to climatic factors favoring wheat selection for disease resistance, scientists welcomed the opportunity to expand wheat among Sonora farmers who had access to machinery, credit, and international, as well as national, markets.[74]

As head of the MAP's wheat effort, Dr. Borlaug explained that during the first several years U.S. agricultural scientists spent much time at large Sonora farms. One of the main farmers Norman Borlaug worked with was Rodolfo Elias Calles, son of a past president and a past governor of the state himself. Among the various agricultural groups in Sonora, including ejidatarios, Borlaug worked primarily with the largest and best financed organization of private producers--the Harvester's Union of Hermosillo. This patronato exercised considerable political power in Mexico as evidenced by its ability to effect federal expenditures in support prices for wheat, irrigation projects, and the maintenance of many land holdings as well in excess of federal laws.[75]

Besides the work Borlaug achieved in the development of rust resistant wheats, he also traveled to Mexico City to facilitate the large-scale cultivation and marketing necessary to increased wheat production. Borlaug served as an

important intermediary between producers and government agencies, arranging federal support for both the shipment of large quantities of fertilizer to be directed to the Northwest as well as commitments by the state to purchase wheat surpluses.[76]

In return for the MAP's provision of techniques for the production of large and marketable yields, the Harvester's Union supported U.S. scientists. In 1954 the Union offered the MAP one hundred hectares of prime land for research and by 1955 the Foundation agreed to help finance an experiment station at Ciudad Obregon. In addition to the partial financing of research according to the needs of the largest farmers, "The salaries of the five professional agronomists and the operating costs of the institution were provided by the federal government, and the cost of the buildings and equipment borne by the Rockefeller Foundation." [77]

U.S. agricultural scientists in addition to research on high yield advised producers to cultivate wheats with other characteristics. The newly introduced varieties, for example, conformed to practice based on mechanical planting, maintenance, and harvesting. Another trait of the new wheats was increased fertilizer use. This augmentation in the use of fertilizer, according to MAP scientists, not only served a biologic design for greater plant growth, it also served a commercial purpose, namely, as "the keys that unlocked the door to the development of the farm machinery business." [78]

The standards used by MAP scientists in the design of genetic materials in wheat, as well as other crops, were derived from the context of capitalist agriculture in the United States. In addition to cultivation traits that reinforced the use of mechanization, improved wheats also promoted specific applications in the food production system. Borlaug and team, for instance, during experiments sent all promising materials to the United States Department of Agriculture for milling and baking quality tests.[79] The USDA measured the performance of Mexican wheats against their standardized measure: 'Gold Medal Flour.' Just as wheats which did not possess resistance to certain forms of rust pathogens were rejected as not suitable for mass production, so too, those wheats that did not meet the demands for industrial processing employed by U.S. food processors were eliminated from further use. Indeed, breeding for disease resistance and commercial potential in the industrial process were often intermingled.

In 1959, for example, Ralph W. Richardson, the last director for the Mexican Agricultural Program, contacted the Rust Prevention Association of Canada to request training for one of the MAP's laboratory technicians, Evangelina Villegas. The executive secretary for the Association responded that arrangements had been arranged for Ms. Villegas' in-service training at the General Mills Lab. These arrangements were simplified by the fact that the chairman for the Rust Prevention Association, Don A. Stevens, also served as an officer with the General Mills Corporation. The Mexican Agricultural Program's link to the Association was further enhanced by a scientific advisor whose employment included both the Association and the Rockefeller Foundation--Dr. E.C. Stakman.[80]

Investigations at Ciudad Obregon became a showplace for U.S. agricultural scientists. In the late 1950s the Foundation regularly brought visitors, including foreign statesmen and corporate executives, to display the advances achieved in Mexican wheat production. By the early 1960s the first of the famed 'miracle wheats' designed by Norman Borlaug spread from the laboratories and fields of Ciudad Obregon. Particularly, the wheat program served as a device for demonstrating and extending internationally the Foundation's research in agriculture.

The experiences of the 1950s demonstrated, nevertheless, that the MAP influenced the methods and magnitude of production affecting a variety of commodities. Excerpts from the "Chronology of the Development of CIMMYT" notes the breadth of investigations and achievements in Mexican agriculture:

1.4 A brief chronology of developments with the O.E.E.,

- 1.4.1 At the beginning research programs on maize, wheat and beans were launched. Programs on other crops such as barley, sorghum, forages, potatoes and vegetables were added later.
- 1.4.2 Development of widespread on-farm research and demonstration plots important in rainfed and irrigated agricultural areas to test new materials and put together technological packages for farmers. This philosophy served as a basis for format of extension services in Mexico and later in many other developing countries.[81]

The achievements of the Mexican Agricultural Program, as illustrated in the CIMMYT Chronology and other histories, have typically described changes in a language that corresponds to a progression of science. A compression of this history appears as: the arrival of scientists; identification of the problem; experimentation and inquiry; and the application of techniques. Not only does this outline fit the activities of any other scientific community but the entire process evokes an image of neutrality. A later retrospective on the MAP written by Edwin Wellhausen in Scientific American exemplifies this tradition of recording the activities of the scientific community in quantifiable terms. Hence, what MAP scientists did is explained as increases in the production of plants and thereby food as well. In this chapter we have begun to explore some of the dimensions in which the scientific project embarked upon by U.S. agricultural scientists in the early 1940s produced changes that extended well beyond the emergence of techniques in service to mankind.

Summary

During the years 1950 to 1960 a team of U.S. agricultural scientists were most active in establishing the contours of a model of Mexican agriculture that continued in years to come. Their activities encompassed the spread and application of various techniques that accounted for the rise in agricultural production. The design of agricultural production included not simply the spread of techniques, but numerous other decisions as well: the promotion of certain kinds of crops, the support of a particular class of farmers, and stimulus to production in particular geographic regions. The examination of certain consequences and the attempt to rationalize and legitimize these outcomes will be treated in a subsequent chapter on the role of social science at the International Maize and Wheat Improvement Center.

This chapter describes the importance of less notable, yet crucial consequences that accompanied the spread of modern agricultural techniques. The important change that occurred in Mexican agriculture at this time was the role of science in setting political agendas. Repeating the Foundation's experience in the management of science, the science of agriculture served, as it had in the southern United States, as a means for redefining productive relations

according to the interests of capitalists in both the United States and Mexico. The logic that led to the selection of farmers, regions, and crops arose from the needs of capital accumulation. Hence, wheat historically produced in central Mexico shifted to the Pacific Northwest largely as a means of supporting the most highly capitalized productive units. Private farmers were selected over communal ones in order to set the tone for state support of private accumulation instead of shared arrangements. These aspects of Mexican agricultural development have been described by various authors, although with generally less acknowledgment of the central role played by U.S. agricultural scientists and the repercussions of this participation.

One of the distinctive theses of this research is that the MAP's design of Mexican agricultural development resulted in the emergence of two additional characteristics which contained considerable importance for the state. These characteristics marked the development of two widely recognized contradictions regarding Mexican development in the twentieth century in which 'science' played a major role.

First of all, MAP scientists demonstrated the ability to successfully challenge the power of the state in contests over the organization and arrangements of production. While the state in capitalist society is often regarded as an agent for class interests, its resolution of conflicts is not deterministic. Particularly in cases where contests occur between factions within the same ruling class (e.g., agrarian versus industrial capitalists), the state cannot be depended upon to act according to a logic that maximizes the accumulation of capital. In the case of Secretary Munoz and his attempt to foster policies supportive of more traditional modes of production, i.e., extensive maize production for national consumption in place of more capital intensive producer association based arrangements, the interests of advanced forms of capital accumulation and organization were not served. In this conflict scientists served as a particularly potent force for defeating an essentially parochial, nationalist, and antiquated capitalist interest.

More than simply serving U.S. interests, Foundation scientists argued against the Munoz plan on the basis of illogical production schemes. The logic, however, was capitalism and not merely a policy set by the Rockefeller Foundation or figures in the United States government. The success

of their contest derived from the ability to employ a scientific language to prevent the promotion of maize. Although political leaders of the 1940s conceived of science and technology as a means of controlling agrarian reform and guiding it toward class interests, by the 1950s scientists represented a force that on certain occasions and in specific settings directed the state towards ends largely defined by their professional, albeit capitalist-bound, interests.

The fact that the Foundation established a political community within the state that in certain respects transcended national interests set in motion a second contradiction also illustrated in the conflict between Secretary Munoz and U.S. agricultural scientists. If indeed the control of the masses depended upon the legitimacy of the state, a specific demonstration of this right to rule depended on very tangible goods, not the least of which included food. As this examination of agricultural development indicates, the professional community of agricultural scientists operated according to their interests and not the state's. The reasons for dedicating the resources of the state toward the production of basic foodstuffs in the early 1950s appeared genuine, even to certain Foundation scientists; yet MAP researchers resisted this agenda and fostered instead a productive organization based on high productivity. The link to food, and here particularly mass consumption items such as maize, became increasingly tenuous as MAP scientists succeeded in the transformation of agriculture. As we shall see, the contradiction between the state's ability to maintain minimal diets and the drive toward capital accumulation has remained an enduring trait of Mexican agriculture since as a result of the design of production constructed by the Rockefeller team of scientists.

In the next two chapters we will explore how these contradictions and conflicts initiated in the 1940s and 1950s led to specific programs in the successor organization, the International Maize and Wheat Improvement Center, that followed the termination of the Mexican Agricultural Program in 1960. More than simply a detailing of how the internationalization of agricultural research has related to capitalism, this research will elucidate some of the political consequences that have accompanied this historic development of internationalizing the science of agriculture.

CHAPTER IV--NOTES

1. See for example, E.C. Stakman, Richard Bradfield, and Paul Mangelsdorf, Campaigns Against Hunger (Cambridge, Mass.; The Belknap Press of Harvard University, 1967); or for a more contemporary collection of retrospectives by participating scientists various essays in the "Food and Agriculture," issue of Scientific American, Vol. 235, No. 3, September, 1976.
2. These reports are best represented in the agricultural journal, started by the Rockefeller Foundation, Agricultura Tecnica, which began publishing technical reports regarding the work of the Mexican Agricultural Program beginning in 1955.
3. George W. Gray interview with Edwin J. Wellhausen, August 15, 1952, p.15 (Rockefeller Foundation Archives: RG 1.2/Series 915/4/25).
4. Ibid., pp. 26-27.
5. Ibid.
6. Edwin Wellhausen memorandum to George Harrar, August 18, 1956, p. 3 (Rockefeller Foundation Archives: RG 1.2/323).
7. Despite the many protests that have been lodged against this argument, by the 1970s even Foundation scientists acknowledged the exclusionary aspects of their work in Mexican agriculture. See, for example, the essay by Edwin Wellhausen in the "Food and Agriculture," issue of Scientific American, op. cit., pp. 128-150.
8. Edwin J. Wellhausen and L.M. Roberts, "Rocamex V-7 una variedad sobresaliente de maize para sembrarse de riego en la mesa central," Folleto de Divulgacion, 3 (Mexico: OSS-SAG, August 1948), p. 21.
9. Kenneth Wernimont correspondence to Theodore W. Schultz, April 28, 1953, pp. 1-3 (Rockefeller Foundation Archives: 1.2/323/4/26).
10. George Harrar correspondence to Warren Weaver, February 11, 1948 (Rockefeller Foundation Archives: RG 1.2/323/3/16).
11. George Harrar report to the Rockefeller Foundation, March 17-20, 1954 (Rockefeller Foundation Archives: RG 1.2/323/4/27).

12. Dorothy Parker correspondence to George Harrar, June 15, 1953, p. 1 (Rockefeller Foundation Archives: RG 1.2/323/4/26).
13. Warren Weaver diary, June 16, 1953 (Rockefeller Foundation Archives: RG 1.2/323/4/26).
14. Cynthia Hewitt de Alcantara, Modernizing Mexican Agriculture (Geneva: United Nations Research in Social Development, 1976), p. 39.
15. Ibid., p. 40. Alcantara notes that by 1948, 80 percent of land dedicated to corn cultivation used IIA varieties.
16. Ibid., p. 38.
17. Weaver's diary, op. cit.
18. George W. Gray interview with Edwin Wellhausen, op.cit.
19. Alcantara, op. cit., pp. 112-113.
20. Ibid.
21. Secretaria de Industria y Comercio, Compendio Estadístico (Mexico: Direccion General de Estadística, 1959), p. 223.
22. Weaver's diary, op. cit.
23. Ibid.
24. Harrar's Report to the Foundation, op. cit., pp. 2-3.
25. Hassan A. El-Tobgy, A.B. Joshi, Vernon Ruttan, and Howard A. Steppler, "External Program Review Panel," p. 7 (Mexico: CIMMYT mimeo, April 24-28, 1972), 22 pp.
26. Herrell De Graff report to Joseph Willits, September 10, 1952, pp. 49-50 (University of Wisconsin: Land Tenure Center Files).
27. Ibid., p. 47.
28. Weaver's diary, op. cit.
29. Secretaria de Agricultura y Ganaderia (Mexico: Instituto Nacional de Investigaciones Agricolas, Winter 1964), p. 156.
30. Hector Diaz-Polanco and Laurent Gye Montandon, La Burguesia Agraria de Mexico: Un Estudio de Caso en el Bajío (Mexico: Cuadernos del Centro de Estudios Sociológicos, 1977), 62 pp.; p. 17.

31. David Barkin and Blanca Suarez, El Complejo de Granos en Mexico (Mexico: Centro de Ecodesarrollo/Instituto Latinoamericano de estudios transnacionales, 1980), p. 51.
32. Susan George, Feeding the Few: The Corporate Control of Food (Washington, D.C.: Institute for Policy Studies, 1981), p. 45.
33. "Where Do We Go From Here," Round-table Discussion of Foundation Scientists, July 29, 1956, p. 7 (Rockefeller Foundation Archives: RG 1.2/323).
34. Anon., "Agricultural, Pastoral, and Forest Industries in Mexico" (Washington, D.C.: U.S. Tariff Commission, 1948), p. 37.
35. Ibid.
36. George Harrar memorandum to Edwin Wellhausen, March 5, 1954 (Rockefeller Foundation Archives, RG 1.2/323/4/27).
37. George Harrar diary, January 15, 1954 (Rockefeller Foundation Archives: RG 1.2/323/4/27).
38. J.G. Dickson correspondence to W. Gibler, January 27, 1954 (Rockefeller Foundation Archives, 1.2/323/4/27).
39. Ibid.
40. Report of 1955 Barley Improvement Conference (Milwaukee: Barley Improvement Association, 1955), Warren Weaver's paper, "Research in Natural Sciences and Agriculture by The Rockefeller Foundation," pp. 74-77.
41. Ibid., pp. 1-6, Appendix A.
42. The Mexican Agricultural Program Annual Report (Mexico: The Rockefeller Foundation, 1956).
43. The Mexican Agricultural Program Annual Report (Mexico: The Rockefeller Foundation, 1957), p. 75.
44. Ibid.
45. The Mexican Agricultural Program Annual Report (Mexico: The Rockefeller Foundation, 1958), p. 76.
46. Ibid.
47. Herrell De Graff, op. cit., pp. 50-51.
48. Ibid., p. 47.
49. "Where Do We Go From Here," op. cit., p. 5.

50. Ibid., p. 6.
51. Ibid., p. 8.
52. Ibid., p. 7.
53. Ibid., p. 8.
54. Ibid.
55. Kenneth Turk, "Preliminary Report to the Rockefeller Foundation," August 31, 1959, p. 1 (Rockefeller Foundation Archives: 1.1/323/2/8).
56. Ibid., pp. 3, 4, and 6.
57. Ibid., p. 4.
58. Ibid., p. 10.
59. Ibid., p. 6.
60. Ibid., p. 14.
61. Ibid., p. 15.
62. Kenneth Turk, "Continuation of Preliminary Report to the Rockefeller Foundation of Animal Science Program in Mexico," September 24, 1959, p. 10 (Rockefeller Foundation Archives: 1.2/323/2/8).
63. Ibid.
64. Ibid., p. 11.
65. Ibid., p. 10.
66. Turk, Preliminary Report . . ." (August), op. cit., p. 14.
67. Ibid., pp. 13 and 14.
68. Anon., "Chronology of the Development of CIMMYT" (Mexico: International Maize and Wheat Improvement Center, October 27, 1978), p. 5.
69. A good indication of this is reflected in USDA Attache Report #MX-0005 (Washington, D.C.: U.S. Foreign Agricultural Service, February 13, 1980), pp. 2-30.
70. David Barkin and Blanca Suarez, El Complejo de Granos en Mexico (Mexico: Centro de Ecodesarrollo/Instituto Latinoamericano de estudios transnacionales, 1980).
71. R. Lamartine Yates, Mexico's Agricultural Dilemma (Tucson: University of Arizona Press, 1981), p. 50.

72. Anon., "Agricultural, Pastoral, and Forest Industries in Mexico" (Washington, D.C.: U.S. Tariff Commission, 1948), p. 32.
73. The evidence for this is presented in the chapter which follows detailing the evolution of the Mexican Agricultural Program with respect to public health and agricultural production.
74. E.C. Stakman, Richard Bradfield, and Paul Manglesdorf, Campaigns Against Hunger (Cambridge, Mass.: The Belknap Press of Harvard University, 1967).
75. Alcantara, op. cit., p. 147.
76. Norman Borlaug, interview.
77. Alcantara, op. cit., p. 169.
78. Norman E. Borlaug, "The Impact of Agricultural Research on Mexican Wheat Production," Transactions of the New York Academy of Sciences, Series II, Vol. 20, No. 3, January 1958, pp. 278-295, 288.
79. Mexican Agricultural Program Annual Report, 1958-1959, op. cit., pp. 63-68.
80. Donald G. Fletcher correspondence to Ralph Richardson, May 22, 1959, pp. 1-2 (Rockefeller Foundation Archives: 1.2/323/46/362).
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5

Defining the Parameters of Professional Competency

By the mid-1950s the Mexican Agricultural Program (MAP) dominated the research agenda in Mexican agriculture. First with its entry into the Ministry of Agriculture with the status of major division in the 1940s; then achieving autonomy and setting out in another direction from the Institute for Agricultural Investigation (IIA) in the early 1950s; and later, grounding local research among commercial agriculturalists in several regions the MAP gained control over the hub of national research by 1955. The course for Mexican agricultural development that followed in the 1960s, 1970s, and 1980s therefore had its antecedents in the team of scientists organized by the Rockefeller Foundation in the 1940s.

In the 1950s the Foundation scientists faced the problem of how to withdraw personnel from Mexico and still maintain the direction set by the MAP. In the short run, Foundation scientists devised ways to gain control over most of the important parts of the Ministry of Agriculture. This objective involved a combination of funding administered by the Foundation along with that contributed by local patronatos into the grid of research stations. Secondly, MAP scientists had to find a means for the creation of an agricultural organization that complemented that of the United States.

The answer rested with the standards of scientific education. The essence of the problem was professional competency: "How could the Foundation leave behind structures that reproduced the agendas created by Paul Manglesdorf, George Harrar, Norman Borlaug and others?" The answer, however, did not rest with particular individuals. Rather, the Foundation had to ensure that institutions responsible for

agricultural education had an orientation similar to land grant colleges or research stations in the United States. Only in this way could a like-minded community of scientists be expected to re-create the values common to the U.S. science of agriculture.

The solutions presented to Mexican agriculture, to capitulate, occurred largely in terms of what U.S. professionals regarded as correct scientific practice. Hence, MAP scientists not only succeeded in pursuing an objective premised on capitalist exploitation, but recast the activities of IIA workers as 'nonscience.' This reinforced the Foundation's experience of obtaining a desired social outcome through the manipulation of ideas and professional communities.

In the 1950s the Mexican Agricultural Program implanted its notions of science in a cadre of young professionals. Many of these trainees, approximately 700, received informal education while serving in the Office of Special Studies (OSS), otherwise known as the MAP.[1] In addition, MAP reproduced the land grant type training in colleges of agriculture at Chapingo and Monterrey. By the early 1960s MAP assured the continuation of an agenda located not exclusively in active class control, but via the passive instrument of scientific research.

This strategy in the management of knowledge was similar to the Foundation. The Foundation discovered, to reiterate points made in Chapter II, that the generation of certain kinds of knowledge and its institutionalization represented an efficient means of obtaining political ends. In a very real sense the early lessons in the guidance of education were simply reproduced later in Mexico. Consider, for example, the comments of George Gray made in the 1920s:

It is interesting to compare the program of the International Education Board in agriculture with its program in the natural sciences. In the program for the sciences all efforts were concentrated on the problem of finding, developing, and strengthening the productive resources of research, the men and the institutions. In the program for agriculture there was similarly a concern for aiding key men and key institutions and promoting the international dissemination of new knowledge.[2]

The first dozen years of the MAP largely encompassed Gray's summary of earlier times. Yet, as we have seen, this apparent consensus did not emerge from a spontaneous or intellectually compelling base. To quote Warren Weaver once more, this 'science' was "more or less stuffed down their throats." [3]

Before turning to the extent that the Foundation participated in defining the limits of professional competency, it is necessary to summarize the nature of Mexican agricultural education. This, after all, represented the baseline from which the Foundation traveled in subsequent years. Particularly important from the perspective of this study is the degree to which a narrow notion of agricultural research was introduced into Mexican education by the Foundation.

Mexican Agricultural Education: From Reform to Research

In the 1940s subtle changes began to take place in Mexican agricultural education. Particularly during the next two decades the foundations for specialized training and the advance of the agricultural sciences occurred at various educational institutions. Accompanying the expansion of these institutions of higher education in agriculture was the growth of a profession of agricultural scientists. By the early 1960s the major schools of agriculture produced a greater number of graduates on an annual basis than all of those trained during the first forty years.

Changes in educational standards and professional competency arose from various factors. Certain of these changes resulted from demands by patronatos for novel kinds of expertise. This expertise often appeared inseparable from the opportunities in international trade and the demands of emerging agribusinesses. So too, the national and state agencies concerned with agriculture also promoted a larger number of technicians. Common, however, to all of these factors and catalytic in the development of each of these stood the Rockefeller Foundation.

The history of institutional and professional development agricultural science in Mexico cannot be fully comprehended without consideration of the role of the Rockefeller Foundation. The standard of competency among technicians trained by the Rockefeller Foundation reflected values that entered in their work. Indeed, the nature of knowledge

generated by Foundation-supported scientists indicates that the most important product was a particular mentality, as well as crops.

In the nineteenth century, Mexican agricultural education was largely an art and craft practiced by missions of small agriculturalists. It involved teaching the necessary skills derived from long years of experience with the ecology of a particular area. The advanced techniques that farmers in the United States already employed for greater yields were largely unknown, even on the more commercial farms in Mexico. One of the single most important elements that accounted for different practices and production between the two countries was the science of agriculture.

In 1856 four major public centers for agricultural research operated in Mexico. The National School of Agriculture at San Jacinto, D.F., served as the primary center for advanced training. In addition, three other schools of agriculture--regional schools--trained students at Veracruz, Morelos, and Nuevo Leon. By the end of the century probably no more than one thousand students received advanced training at these centers.[4]

Education at these and lesser institutions included basic training in farming with an emphasis on management. Many, if not most, of the graduates from these centers, upon completion of their studies, worked on large ranches or haciendas.[5] The fact that education in agriculture fostered increased productivity and profits accruing to only a small segment of all cultivators did not appear as a concern to early technicians.

With the arrival of the Mexican revolution, however, both general and specialized studies in agriculture entered a period of prolonged controversy and struggle. While there grew a recognition of agricultural research as conducted in the United States, the revolution combined technical interests in agriculture with ones concerning the social, political, and economic nature of production. The emphasis given to agrarian reform presented an obstacle to the transfer of knowledge and techniques from abroad, chiefly the United States, as sufficient grounds for their application in Mexico.

In later years Mexican agricultural scientists referred to the immediate post-revolutionary years as a period in which scientific advance was disrupted by disorderly social,

political, and economic conditions. One account, for example, constructed by technicians trained and supported by the Rockefeller Foundation described the revolution as a hindrance toward the development of a professional corps of agricultural scientists.

The Government's decision of distributing the available land during 1915 to 1930, occupied the efforts of the existing technicians. . . . The need for agricultural research was keenly felt in 1915, but due to the instability of the Revolutionary Government, it did not progress.[6]

These professionals noted that at various educational centers, such as the National Agricultural School at San Jacinto (later moved to Chapingo), the orientation of education in the early 1920s changed from one of serving wealthy agriculturalists to extensive social service. A later complaint expressed by many of the U.S. trained scientists alleged that while research prior to the revolution had perhaps served too few, afterward productivity suffered because of attempts to direct benefits to so many who lacked minimal requirements for 'successful' farming.[7]

Another perspective indicated that the failure of research did not result from problems inherent to the revolution. Rather, the problem arose as a result of the nature of agricultural organization. President Plutarco Elias Calles in 1925 formed eight technical schools of agriculture called 'centrales agricolas.' [8] The centrales, patterned after land grant colleges in the United States, focused attention on experimental methods and procedures for the improvement of plants and cultivation practices as a means of advancing agricultural production. Although the centrales introduced novel features into the study of agriculture (e.g., purebred animals, sophisticated machinery) these United States transplants had little practical application for conditions outside of experiment plots. A contemporary observer of Mexican education wrote in 1936 an analysis that contrasted markedly with that written in later years by Mexican scientists: "The failure of these transplanted agricultural colleges demonstrated conclusively that Mexico's salvation must be accomplished by an application of Mexican means and methods." [9]

In 1932 the centrales were converted into regional rural schools. In place of a technically sophisticated

training, the regional rural schools emphasized basic education for practical farmers. The intent of this schooling aimed at the training of rural teachers as a means of reaching more of Mexico's agriculturalists and making more gradual improvements in farming. In addition to basic agricultural instruction, the rural schools encouraged the formation of communal enterprises and social action. The children of ejidatarios and small farmers received enrollment preference.[10]

The nature of agricultural education underwent further changes during the government of Lazaro Cardenas (1934-1940). Educational institutions that previously replicated the agenda of U.S. land grant colleges were subjected to questions about the purpose and beneficiaries of the research in the plan set forth by the Secretary of Public Education, both elementary and advanced educational institutions altered their pedagogy. Discussions of politics were directed moreover at the continuing struggles of the revolution.

A plan developed for the primary levels of education, for example, regional peasant schools (e.g., Escuelas Regionales Campesinas) outlined the following discussions of the "political problem":

- b) 'disorder' as a natural phase of readjustment between economic class;
- c) the owner's class use of economic force to implant dictatorship;
- d) Imperialist economic penetration as a tool of foreign intervention.[11]

Other bases of discussion referred to problems of health in terms of physical conditions, the influence of 'Yanqui' culture on Mexico, and the problems of foreign debt.

The fact that indigenous capitalists sought a path between the excessive and damaging policies of Porfiro Diaz and foreign domination suggested that state managed capitalism offered the best solution. Yet, when combined with the popular roots of revolution, the course came dangerously close to the possibility of popular domination over economic organization. This possibility expressed itself most clearly in the case of education.

At the National School for Teachers (Escuela Nacional de Maestros) the curriculum reflected the growing content of political interpretation in a variety of traditional

studies. Under a section of teacher preparation entitled "Political Economy and Economic Problems of Mexico" the following course of study appeared:

- I. Historic Antecedents
 - 1. Origins of capitalist society, industrial revolution and its consequences.
- II. Scientific Socialism
 - 1. Dialectical Materialism
 - 2. The law of capitalist development.
- III. Economy
 - 1. Economic development and Society; social division of labor; forms and functions of value; bourgeoisie theories of value.
- IV. Economic Problems of Mexico
 - 1. The exploitation of land; origins of the hacienda; agrarian problems of Mexico.[12]

The extent to which this plan ever became manifest in public schools was probably uneven at best. The document, nonetheless, reflected the degree to which the struggles of reform or revolution continued to embroil, not simply antagonistic classes, but state institutions.

This struggle extended to professional associations, such as the League of Socialist Agronomists. While in certain respects the League fostered a notion of state capitalism, it also advanced contradictory notions. In the area of public agricultural education, for instance, the League pressed government officials to redesign the system of education such that curricula be defined by the majority of agriculturalists, i.e., subsistence agriculturalists. While this proposal obviously fell short of giving popular control over to those who tilled the soil, this hardly promoted an efficient transformation of rural production toward capitalist production.[13]

By the close of the Cardenas administration, education, and especially agricultural education, ignited a debate within the still emerging profession of agricultural scientists. Were professionals obligated to maximize production on private lands or to make research relevant to collectivized ejidos? As land seizures and food riots expanded in the early 1940s issues of agrarian reform invaded professional discussions.

In the early 1940s certain officials with the Ministry of Agriculture who promoted collective over private property occupied positions of authority in the Institute for Agricultural Investigations, or the IIA as it was known by its Spanish acronym. This group of researchers represented an alternative to the importation of U.S. agricultural methods. One scholar of Mexican agriculture described this group as fundamentally opposed to the Office of Special Studies that also operated within the Ministry: "They believe that increased production in the Mexican countryside was intimately linked to structural changes which would break up large, capitalist farm holdings and create viable cooperatives of peasants and workers in their place." [14] The MAP, in contrast, had another plan that it favored for Mexican agriculture. In place of discussing and examining differences with the IIA, the Foundation's scientists sought to remove those items from consideration. Rather than confronting those issues directly, the Foundation during the 1950s purged notions of agrarian reform, collectivization, and politics from professional discourse. A central means in the achievement of this objective involved the Foundation's determination of the limits of professional competency.

Mexican Agricultural Education: Constructing Professional Competency

Since the 1940s the Rockefeller Foundation relied on educational grants to send Mexican trainees, or 'tecnicos,' who supported MAP activities, to U.S. land grant colleges for advanced training. As a remedy for what U.S. agricultural scientists regarded as the problem of agricultural education in Mexico, the grants filled an immediate need for more specialized training. Mexican schools of agriculture, according the Rockefeller scientists, lacked the ability to produce highly trained scientists.

While the solution of sending its trainees to the United States at first appeared satisfactory, the late 1940s it became clear that Mexico could not be expected to continue educating its professionals abroad. In order for the agenda of science in agriculture to be maintained after the departure of the Mexican Agricultural Program, the Foundation funded agricultural education. The guidance provided at Mexican schools of agriculture revealed the nature of agricultural research fostered by the Rockefeller Foundation.

The monies allocated by the Foundation in 1949 went to three universities: the National School of Agriculture at Chapingo, the University of Coahuila at Saltillo, and the Technological Institute for Advanced Studies at Monterrey. [15] The purpose of these monies, in the words of Foundation officers, provided for the training of more agricultural scientists. Yet, the nearly twenty-five thousand dollars (U.S.) supplied these schools with more than simply the ability to produce greater numbers of graduates; the Foundation purchased a particular kind of competency as well.

Neither Dr. Harrar nor his colleagues wanted simply to create a professional force beholden to the MAP or even the Foundation. Their main objective was the imposition of a standard consistent with that used by U.S. agricultural scientists. Indeed, MAP scientists referred to their program at Chapingo as patterned after the land grant colleges.

By 1952 the Foundation grants to these three schools totaled \$150,000 (US) for a four year period. Ed Wellhausen explained the purpose of 'improvements' during an interview in 1952:

Yes, it's under way at Chapingo, Saltillo, and Monterrey, perhaps further along at Monterrey than it is at the other two places. That helps them to get better teachers and more teachers, to improve the library facilities, and to buy more equipment where they might need it. The idea in Chapingo is to use this money to help them establish a research and teaching institution, where the teachers are paid according to the number of classes they teach, someone has to come in and put up the money for more teachers--either the school itself or some outside agency. [16]

The Foundation, in the 1950s and early 1960s, was the primary 'outside' agency.

Why 'better teachers?' At first glance the difference between U.S. and Mexican teaching faculty appeared to be one of scientific sophistication. Courses in soil science, genetics, plant pathology, and so on drew on a greater wealth of information and practice in the United States than existed in Mexico. The improvement of scientific education appeared to be a classic example of apolitical transfer of knowledge, pure science, from one profession to another.

Yet as mentioned in the review of Mexican education, the boundary between science and society remained contentious following the revolution. With the vacillation of political power, education moved from a pre-revolutionary agenda set by hacendados to a post-revolutionary condition that swung uncertainly between questions of technical control and the social organization of agricultural production. Groups such as the League of Socialist Agronomists, supporters of Lazaro Cardenas, members of the Institute of Agricultural Investigations, and other stirred debates that extended to the nature of agricultural research.

One of the difficulties faced by the Rockefeller scientists began with the need to establish an acceptable standard of agricultural research. What it demanded from its tecnicos included not only a sophisticated knowledge about the science of agriculture, but a recognition of the boundaries between scientific practice and non-science. Their willingness to accept U.S. standards of competency marked the degree of success achieved by the Mexican a program.

The record of Mexican agricultural education revealed that by the 1940s many thousands received some degree of training at various of the national institutes.[17] This training ranged from a few with an advanced degree of technical instruction to thousands with a broad-based, practical background. From this pool of talent, the Foundation scientists selected exclusively from among those with a greater emphasis in the technical control of nature. From the points of view of the Foundation, the thousands of minimally trained farmers were by-passed because of the other kinds of knowledge they could be expected to bring to agricultural research. Those with less technical backgrounds confused what Foundation scientists claimed to be the division between science and politics.

Drs. Harrar and Wellhausen explained the conscious decision by the MAP to recruit young Mexicans with a technical background in science. They explained this selection process as a means to ensure that agricultural research proceeded along scientific, not partisan, lines. MAP scientists noted that older teachers, tecnicos, and officials often reflected orientations colored by the destabilized events of the past thirty years.[18]

Yet the combination of eliminating practically trained campesinos and those involved in agrarian reform and the preference for young technically trained recruits did not

signify the elimination of politics. Rather, the replacement of decisions predicated on a discussion of agrarian reform with one of science merely obscured the substance of the political agenda being constructed by U.S. agricultural scientists. The ideology of those schooled in the tradition of U.S. land grants acknowledged technical aspects of production, while avoiding an understanding of the social consequences. MAP scientists directed the perception of their tecnicos toward the linkage of crops and food production while at the same time obliterating connections between the organization of agriculture and land tenure, diets, work, household economy, or political control. While MAP scientists did not possess the ability to brainwash younger men, they did occupy a position of certifying professional status.

In addition to their activities in the field, MAP scientists participated in the construction of professional schools in Mexico. The agenda of pedagogy set in motion at Chapingo and Monterrey regularly involved Foundation scientists. The Rockefeller Foundation engaged in both the staffing of departments with MAP 'graduates' (i.e., tecnicos) and the definition of the components necessary for professional training. As early as 1952 the Foundation reported the success at influencing the "strategically located" School of Agriculture at Monterrey:

The entire staff of the School of Agriculture of the Institute at Monterrey are products of the Rockefeller Foundation program in Mexico, with the single exception of a veterinarian who teaches animal science. The agricultural curriculum of the College was developed in consultation with Dr. Harrar and other staff members of the Office. Most of the faculty have received postgraduate training as Foundation scholars or fellows and doubtless others will be considered for similar experiences in the future.[19]

The fact that Foundation scientists choose to develop Monterrey from among a number of possible educational centers in Mexico dovetailed with its support of patronatos. One historian described ITESM's origins as "founded by groups of executives of large firms as non-profit educational ventures" whose purpose it was "to produce technicians and administrators as human resource inputs." [20]

Wellhausen criticized teaching at Mexican schools of agriculture as lacking a coordinated research plan. At Chapingo, for example, Wellhausen noted that teaching often proceeded without reference to MAP research. The purpose of Foundation grants to Chapingo, as elsewhere, involved the fitting of teaching to research and not vice versa. As evidenced in a 1952 seminar at Chapingo, education served as a vehicle to further integrate the operations of government and the university with those of industry and finance:

We hold a seminar at eleven o'clock every Saturday. At that time we bring together all the young commissioned personnel and the staff to discuss various phases of the program, the work going on; different individuals report the results of their experiments. Or we might bring in outside speakers, might bring in a man from the National Corn Commission to give us a summary of the work that is going on there. Or a man from the National Wheat Commission, or commercial people, such as La Hacienda.[21]

As discussed in the previous chapter, the greatest source of research came from the demands of various growers, producers, and agribusiness. At experimental stations organized by the MAP in commercial agricultural districts, scientists promoted employers' associations, or patronatos, to list their research demands. One of the primary tasks of scientists and tecnicos involved relating these demands to further investigations at Chapingo, Saltillo, and Monterrey. John Pino (the Foundation's animal scientist), for example, worked with the powerful Livestock Union and channeled their research needs to the agricultural schools at Chapingo and Monterrey.

The work that linked teaching to commercially oriented research also merged with the Foundation's effort to place its trainees in authoritative positions with government and industry. Dr. Harrar noted in a 1954 report to the Foundation that MAP trainees made their presence strongly felt in state agencies and subtly influenced the direction of Mexican agricultural policies:

As examples, it might be pointed out that over forty of the key positions in the federal extension program are held by "graduates" of the O.E.E. [Mexican Agricultural Program]; the entire agricultural staff of the State of Mexico has been

drawn from the O.E.E.; every agricultural school in Mexico numbers among its faculty persons who have had training in the Office, and the agricultural school of the Institute of Monterrey has a senior faculty composed entirely of O.E.E. "graduates." Other young Mexican scientists who have formerly been associated with the Office are now found in agricultural banks, working with State and Federal experiment stations, with the Union of Sugar Cane Producers, in the Division of Disease and Pest Control Quarantine, working with cotton cooperatives, with commercial tobacco producers and farm machinery companies.[22]

Dr. Harrar explained that a problem during this period occurred with the agribusiness that competed for MAP graduates at the same time that the Foundation worked to locate these people in positions of political authority.

As MAP tecnicos gained authority throughout Mexico, Foundation scientists worked to meld these people into a nationwide system. In 1955 the MAP organized agricultural demonstrations using fertilizers, insecticides, and fungicides. These demonstrations brought together MAP tecnicos from the Extension Service and the School of Agriculture at Monterrey. The project, because it required high levels of capitalization, brought together government and education officials with wealthy agriculturalists at demonstration sites in Hidalgo, Queretaro, Guanajuato, Jalisco, Michoacan, Durango, San Luis Potosi, Coahuila, Nuevo Leon, Tamaulipas, Veracruz, Oaxaca, and Campeche.[23]

By the mid-1950s various scientists associated with the Foundation recognized the imprint that their efforts had made on Mexican agriculture. Part of this evidence appeared in terms of productivity. Other evidence bespoke of graduates who populated various ministries, universities, and private sector firms. In spite of their success, MAP scientists remained anxious about the future course of Mexican agriculture.

A 1956 meeting gathered together twenty-one of the Foundation's agricultural scientists to consider the future of the MAP. At a roundtable discussion entitled "Where Do We Go From Here?" scientists pondered the future of plant science, animal/forage, and agricultural extension. The discussion centered on the problem of how to perpetuate the

logic of U.S. designed agriculture in Mexico. Education and training emerged as the logical device to achieve these ends.

Dr. Young, an entomologist with the MAP, served as leader and started by wondering how and to what extent the Foundation should become involved in education.

This portion of the discussion takes the emphasis from the physical and biological sciences to dealing with people--attitudes, outlooks, contacts with other people and institutions . . . Will Mexico really become an industrialized country or is she merely in the process of making poverty more tolerable? This will be a factor in our whole program . . . The education problem is of such magnitude that the RF should enter the field further and along what lines. We might begin by talking about Chapingo.[24]

Young suggested that if the RF got further involved in education, a "small amount of money expeditiously placed might be useful at Chapingo." Wellhausen concurred with Young, stating:

To build competent staff some of the money would probably have to be put into salaries. If a graduate school could be developed (the time now seems right), it would be necessary to provide staff, possibly from other countries or using MAP Ph.D.s. The point is to bring research men to teaching rather than vice-versa. The present teaching staff at Chapingo is not research minded.[25]

The reorganization of education at Chapingo constituted a shift from a study of social and physical aspects of production to an apprenticeship focused on production techniques. As the roundtable continued, Dr. Efferson, an agricultural consultant serving the Foundation in South America, reflected the sentiment that education must be programmed:

The real point is that we should organize this program as though we thought it were going to last forever but at the same time have it so that it would go on if we pulled out tomorrow. We need to organize it now like we think the Mexicans should continue it.[26]

How Foundation scientists thought the Mexicans should 'do' agriculture was linked to what they understood the science of agriculture to be. During the 1950s the Foundation expended large sums of money at Mexican schools of agriculture in order to determine the boundaries of research and training. The consensus of MAP scientists took root in the program to design and thereby guide what Mexican professionals in the agricultural sciences understood to be legitimate inquiries and the knowledge necessary for the resolution of problems.

Knowledge and Authority in Mexican Agriculture

In the 1950s the Mexican Agricultural Program constructed a training enterprise that was preeminently technical. From 1954 to 1964 the Foundation concentrated training fellowships in the fields of plant breeding or genetics, plant pathology, soil science, and entomology. These four fields comprised no less than 60 percent of the educational grants for fellows during any single year.[27] As tabulated in Appendix A, these fields represented more than 80 percent in the first years and continued to dominate professional training in the early 1960s. In addition, many other fellowships in fields categorized as distinct--agronomy for example--often contained an educational content closely related to that found in these other disciplines. In such areas as forage, livestock, or chemistry, research dovetailed with efforts to rationalize agricultural production.

In addition to concentrating fellowships in a few selected fields, the Foundation often sent trainees to the same land grant institutions in the United States. Between 1954 and 1964 approximately half of the Mexican fellows went to ten agricultural schools in the United States: Iowa State College, Texas A & M, Cornell University, University of Minnesota, University of Wisconsin, Kansas State University, Purdue University, University of California, North Carolina State College, and the University of Illinois.[28]

As the Foundation concentrated fellowships at certain land grants it also stimulated particular research with additional funding. Appendix B describes the kinds of research projects the Foundation underwrote from 1959 to 1962 at this group of college. That research spanned a variety of topics such as wheat pathogens, maize genetics, fungicide residues, and animal nutrition. Common to each of these were the

commercial applications and organization of agricultural production on an industrial scale. The result was a further definition and guidance of investigations by young Mexicans.

In a conventional sense the Foundation's support of agricultural education followed a course which, because it reproduced the model of U.S. land grant schools, appeared perfectly natural. When seen in the light of the Mexican context and especially the pervasive debates regarding agrarian reform, this orientation was less 'natural'--indeed it represented an effort to impose on that country a foreign political agenda. By placing the exact sciences of genetics, pathology, and others at the center of professional competency, questions of 'for whose benefit?' were consigned to oblivion.

The Foundation's utilization of the exact sciences served, therefore, a dual purpose. On one hand the various techniques that grew out of the U.S. land grants promoted a reorganization of Mexican agriculture along the lines of efficient capitalist production. At the same time, the identification of the natural sciences as the basis for professional decision-making eliminated other types of knowledge as necessary to the organization of agriculture. In succeeding chapters we will examine more specifically how professional knowledge became bounded and the political implications. For now, it is important to understand that the management of professional competency by the Foundation brought forth the perpetuation of a political agenda and institutional domination.

The Reorganization of Institutional Research

In 1960 the Mexican Agricultural Program formally concluded its technical assistance mission. The termination of the MAP signaled an agreement between the Rockefeller Foundation and the Ministry of Agriculture that Mexico now possessed the resources necessary to conduct its own research and development. But in addition to these public proclamations, the end of the Rockefeller mission marked the domination of research designed by U.S. scientists.

A reorganization of the Ministry of Agriculture accompanied the withdrawal of the Rockefeller mission. Along with several other divisions, the Foundation's Office of Special Studies and the Institute of Agricultural Investigations were merged into the National Institute for Agricultural

Investigations, or INIA as it was popularly referred to. The fusing of previously antagonistic research communities was a further triumph by the Foundation scientists.

In INIA the major departments continued under the leadership of MAP scientists and their tecnicos trained in the Office of Special Studies. Heads of the major divisions at INIA testified that the supposed merger between IIA and the OSS in reality marked the demise of IIA. The top six positions in INIA in 1960 were filled as follows:

Director General

Rodolfo Peregrina (Rockefeller Fellowship 1946-1948; assistant soil scientist for MAP 1954/1955)

Co-Director General

Ralph W. Richardson (Rockefeller Foundation Staff)

Assistant to Co-Director General

Douglas Barnes (Rockefeller Foundation Staff)

Assistant to Co-Director General

John A. Pino (Rockefeller Foundation Staff)

Sub-Director General

Nicholas Sanchez Duron (Rockefeller Foundation Fellowships: 1954-1959)

Technical Sub-Director

Jose Guevara Calderon (Rockefeller Foundation Fellowships 1955-1957)[29]

In addition to the top slots in the organization being occupied by either Foundation scientists or their tecnicos from the MAP, major divisions within INIA contained many older MAP tecnicos or fellows who received training in the United States with Foundation fellowships. That group held leading positions in sixteen of the twenty-five sections, including the offices of Varietal Improvement in Corn and Sorghums, Varietal Improvement in Small Grains, Varietal Improvement in Beans and Soybeans, Varietal Improvement in Potatoes, Horticulture, Improvement of Forage Grasses and Legumes, Forage Utilization, Soil Fertility, Insect Pests and Their Control, Plant Pathology, Weeds and Their Control, Seed Laboratory, Poultry, Veterinary Medicine, Agricultural Economics, and Agricultural Information (see Appendix C for detailed listing of personnel).

The divisions headed by MAP scientists and their trainees represented, moreover, the most strategic divisions

within INIA in terms of organizing a production. Among those sections not managed by MAP scientists and their tecnicos were: Construction/Maintenance and Development, Library, Climatology, Biometry, Soil, Varietal Improvement of Cotton, Varietal Improvement of Sugar Cane, Varietal Improvement of Oil Seed Crops, and Tropical Crops.[30] The reorganization of federal-supported agricultural research, therefore, constituted nothing less than a bureaucratic coup staged in the name of professional authority.

Within two decades the Foundation had transformed several disparate scientific collectives into a single community. The Foundation's influence encompassed extension services at both the state and federal levels, university faculty and curriculum at major schools of agriculture, national and international business firms, large commercial farms, all of the major experiment stations, private and national banks, and various federal agencies related to Mexican agricultural development. In the chronology later constructed by past MAP participants the role of training appeared as a major accomplishment:

Each stage of the above [training] was used as a means of selecting on the basis of excellence for the next level of training and many people believed this training effort was the important development in Mexican agriculture in the 1940s and 1950s. Not only did it create a body of leaders who later directed Mexican agricultural agencies, but it set the pattern for advanced academic training which was later followed by the Bank of Mexico, CONACYT, and other institutions.[31]

Beyond 1960 various of the MAP's tecnicos assumed positions of authority in other institutions in addition to higher levels of leadership at the Ministry of Agriculture (Secretaria de Agricultura y Recursos Hidraulicos--SARH). In 1968, for example, Nicholas Sanchez Duron became the director of INIA. Oscar Brauer Herrera became the director of post-graduate studies at Chapingo. By 1974 another MAP tecnico, Francisco Cardenas, became the next director of INIA and Dr. Lauro Bucio Alanis the next director of post-graduate studies at Chapingo. In this same year, Oscar Brauer Herrera served as the Secretary of Agriculture. By 1980 the leadership of INIA passed on to yet another Foundation trainee, Eduardo Alvarez Luna, as did the directorship of post-graduate studies at Chapingo, Eduardo Casas Diaz.[32]

For more than twenty years since the end of the Rockefeller mission, the national research institute and the nation's major agricultural university continued to be administered by Foundation trained scientists.

The legacy of the Rockefeller Foundation mission in Mexican agriculture involved more than simply a fraternity of individuals. More important was the fact that by the late 1950s the standard of competency used to certify one's authority in decisions about agriculture represented a measure constructed by the Rockefeller Foundation in unison with U.S. agricultural scientists. This participation in the definition of scientific competency guaranteed an outcome that was essentially private, not public.

The fact that the Rockefeller Foundation funded and thereby created the only institutions capable of granting advanced degrees in the agricultural sciences constituted a monopoly regarding the standards of competency. The major fields of study at the post-graduate program in Chapingo included: botany, agricultural investigation, agricultural economics, entomology, statistics, plant pathology, genetics, irrigation, soils, forestry, and agricultural development.[33] The only point at which these disciplines explicitly intersected with considerations of social consequences occurred in the last mentioned category, agricultural development. Under the direction of Foundation scientists or researchers who held short-term appointments this field of study operated to integrate a production into a capitalist economy. While more will be said on the role of agricultural economics in a succeeding chapter, it is necessary to recognize that for all of the fields of training at Chapingo, none promoted an analysis which would consider the standards of professional competency. Scientists trained at Chapingo, like their counterparts in the United States, simply enacted tasks, referred to primarily by virtue of their location in certain institutions, labeled science. To repeat, a dubious aspect of what went on at Chapingo, the National Institute of Agricultural Investigations, and other institutions molded by the Rockefeller Foundation is not that this did not represent science; rather, it did not embody objective knowledge or the only science of agriculture. The Foundation's management of science during preceding decades provided ample testimony that its mission did not culminate with unguided inquiry. The training of a cadre of Mexican scientists, as noted in one of the Foundation's earliest memorandum on the subject, incorporated training at both a conscious and subconscious level: "These young men would

serve as technical assistants in connection with the laboratory experiments and field tests, and at the same time, they would learn the methods and become indoctrinated in the standards of agricultural research." [34]

In its material dimensions this training, as described in the last chapter, facilitated capital accumulation through the reorganization of production in the countryside. This episode has been written on elsewhere and in other places in literature commonly referring to the phenomena of 'green revolution.' As we have seen this process is intimately linked to the rise of scientists whose standards legitimize an unequal social order. The cognitive dimensions in communities of scientists managed by the Foundation ensured a misapprehension regarding social consequences. Whereas Mexican scientists in the 1930s and 1940s oftentimes saw fields in terms of agrarian reform, those who replaced them and stood in the same fields from the 1960s onward saw only the potential for one or another technique. The standard of competency that operated in graduate schools at Chapingo, Monterrey, and the many other institutions that emulated these located responsibility for consequences beyond productivity elsewhere. The arrangement in which allegedly neutral knowledge provided scientists with legitimate authority, yet powerless to direct their work toward goals other than the accumulation of capital, bespoke of the fundamental contradiction between the growth of science and its benefits to mankind.

Although the Foundation succeeded in perpetuating its agenda with the production of research, this contradiction also endured at both Mexican and international research institutes. During the 1960s the contradiction became manifest in a variety of ways. In the next three chapters we will examine the specific conflicts that arose both within and outside of the Foundation's community of agricultural scientists and its efforts to mediate and resolve these. Indeed in 1960 the most difficult tasks yet awaited the Foundation in its management and production of scientific communities on an international scale.

CHAPTER V--NOTES

1. Anon., "Chronology of the Development of CIMMYT" (Mexico: CIMMYT, October 27, 1978), pp. 6-7. The report states that an estimated 750 Mexicans received scientific training with more than 400 to the Master's Degree and about 75 to the Ph.D. level. The report also noted that prior to 1959 no graduate schools in agriculture existed in Mexico.
2. Minutes of Staff Conference, December 27, 1922 (Rockefeller Archives: RG3/904/2/12), p. 52.
3. Warren Weaver, inter-office correspondence to Chester I. Barnard, September 21, 1950, p. 2 (Tarrytown: Rockefeller Foundation Archives), 323/3/21.
4. Leonel Robles, Agricultural Education, Investigation and Extension in Mexico: A Preliminary Study (Mexico: The National Association of Directors of Agricultural Schools, 1964), p. 27.
5. Ibid., p. 45.
6. Ibid., p. 107.
7. This sentiment was expressed in opinions given by various CIMMYT scientists interviewed during the summer of 1980.
8. George I. Sanchez, Mexico: A Revolution by Education (New York: The Viking Press, 1936), pp. 145-146.
9. Ibid.
10. Ibid., p. 150.
11. La educacion publica en Mexico 1934-1940 (Mexico, D.F.: Secretaria de Educacion Publica, 1941), p. 103.
12. Ibid., pp. 349-350.
13. This interpretation is, of course, a contentious one. The largest body of 'radical' literature concerning Mexican history agrees that Cardenas' 'socialism' more accurately represented a state subsidization of capitalist economy. Yet for particular groups, especially with respect to the agrarian question, their intention aimed at the growth of state control as a means of dissolving capitalist relations. A premise of this paper is that the role of the state in agriculture remained problematic between these goals of state socialism and

state capitalism until the arrival of the Mexican Agricultural Program. This author argues that particularly U.S. agricultural scientists played a critical role in resolving the agrarian question and founding the contemporary mode of agricultural production that currently dominates Mexican economic and social life.

14. Cynthia Hewitt de Alcantara, Modernizing Mexican Agriculture (Geneva: United Nations Research Institute for Social Development, 1976), p. 19.
15. Rockefeller Foundation Program in the Agricultural Sciences (New York: The Rockefeller Foundation, 1960-1964); Mexican Agricultural Program Annual Reports (Mexico, Office of Special Studies, 1954-1959).
16. George W. Gray, interview with Edwin Wellhausen, August 15, 1952 (Tarrytown: Rockefeller Foundation Archives: 323/4/25, p. 22).
17. Agricultural Education, . . . op. cit., p. 27.
18. Interviews with George Harrar and Edwin Wellhausen.
19. "Mexico: Agricultural Education" (Tarrytown: Rockefeller Foundation Archives, June 20, 1952), RG 1.2/323/42/293; p. 2.
20. Thomas Noel Osborn II, Higher Education in Mexico (Austin: Texas Western Press, 1976), p. 95.
21. George W. Gray, interview with Edwin Wellhausen, op. cit., p. 7.
22. J. George Harrar, memorandum to the Rockefeller Foundation (Tarrytown: Rockefeller Foundation Archives, June 24 to August 12, 1954), 323/4/29; pp. 5-6.
23. Mexican Agricultural Program Annual Report, 1955-1956 (Mexico: Office of Special Studies, 1956), p. 8.
24. Minutes of Discussion, "Where Do We Go From Here?" (Tarrytown: Rockefeller Foundation Archives, July 24, 1956) 323 (not catalogued); p. 9.
25. Ibid., p. 10.
26. Ibid., p. 13.
27. Rockefeller Foundation Program in the Agricultural Sciences, op. cit.; and, Mexican Agricultural Program Annual Reports, op. cit.

28. Ibid.
29. The Rockefeller Foundation Program in the Agricultural Sciences (New York: Rockefeller Foundation, 1960-1961), pp. 11-20; Mexican Agricultural Program Annual Reports, 1954-1959, passim.
30. The Rockefeller Foundation Program in the Agricultural Sciences, op. cit.
31. Chronology of the Development of CIMMYT, op. cit., p.6.
32. Ibid., Appendix A.
33. The Graduate School at Chapingo.
34. Agricultural Minutes, "Training Agronomos in the Programs" (Tarrytown: Rockefeller Foundation Archives, December 1952) 33 (not catalogued), p. 36.

Agricultural Research: Relations Between Science and Society

The Mexican Agricultural Program (MAP) since its inception in 1943, had come under the jurisdiction of the Division of Natural Sciences (DNS) within the Rockefeller Foundation. Budgets regarding personnel, equipment, and administration followed from decisions set by the head of the DNS, Warren Weaver. As a practical matter, however, MAP activities were largely determined by the Foundation's 'Field Director for Agriculture,' J. George Harrar.

As discussed in Chapter III, the parameters for identifying MAP activities in the early 1940s involved various challenges. Reports drafted by Carl Sauer and members of the Foundation's Division of International Health (DIH) posed problems concerning the mission as conceived by Stakman, Mangelsdorf, and Bradfield. While Sauer and DIH researchers were easily enough dismissed, the contentions regarding the MAP's purpose continued throughout its history. Questions about MAP activities persisted precisely because of the refusal by Foundation scientists to give serious attention to the social consequences of their work.

The issue regarding the direction of MAP activities arose in discussions about jurisdictional boundaries between Foundation divisions (e.g., DNS, DSS, and DIH) in the 1940s. While full documentation regarding this issue is lacking, discussions centered on the adequacy of a mission restricted to improving agricultural techniques.

In 1949 Warren Weaver drafted a memorandum to both J.G. Harrar and Chester I. Barnard, president of the Rockefeller Foundation. Weaver urged Foundation officers to consider the formation of a joint operations committee to oversee MAP. The proposal provided a means for expanding MAP

activities to include matters beyond the design of biology for agriculture.

Barnard responded negatively to the idea of a joint committee. While acknowledging MAP activities included aspects other than ones conventionally a part of natural science, he argued that authority rested with Harrar.

Whether or not Harrar employs anyone coming under the heading of social scientist depends upon whether he needs him and for what he needs him, but certainly he should not employ or even admit anyone of any designation whom he does not need from the standpoint of the operating requirements of the main task he has to carry out, and despite the fact that it would always be hoped that some scientific knowledge would be secured as a by-product of the operation.[1]

Barnard's statement represented one of the few occasions when Foundation officers suggested that the real purpose of the mission rested with social, not scientific, objectives. If doubts remained among any division heads concerning the nature of the mission, Barnard attempted to eliminate this misconception, stating: "The operation should not be conceived as primarily or even secondarily a laboratory for any scientific purposes, and the extent to which scientific observers of any kind--NS (Natural Science), SS (Social Science) or others--should be permitted to mess into the works depends upon the practical degree to which Harrar can take it."[2]

Barnard's memorandum revealed what had been established years ago when the Foundation entered into the management of science. Science's value, from the Foundation's perspective, did not occur with simply greater knowledge. Only certain kinds of knowledge held value. The identification of what kind of science were valuable constituted a continual task for the Rockefeller Foundation.

In spite of successes with organizing scientific communities around certain objectives, the Foundation had to constantly monitor and evaluate these communities in their early stages. This requirement arose from the need to establish inquiry around certain agreed-upon objectives and check its movement into other, less certain areas. An important example in this regard was the subject of agricultural economics.

As suggested by John S. Dickey in 1951, "the Foundation is not and will not be primarily concerned with the long-range problems of practicality involving major political, economic, and social decisions and operations." [3] While Dickey's recommendation generated agreement among many in the Foundation, it also failed to address certain issues. The Foundation's objective in Mexico was long-term. Rather than simply providing short-term aid to commercially oriented farmers, the Foundation worked to construct a permanent orientation among state bureaucracies, educational institutions, and professionals toward commercial agriculture. Dickey's proposal pointed to the inadequacy in the Foundation's mission to provide a response to conflicts that Dickey anticipated to blossom in the countryside following the spread of MAP 'improvements.' Without some means of addressing and treating these consequences, the Foundation faced the possibility that its efforts to engineer a permanent basis for capitalist agriculture might become unraveled.

Contentions over the jurisdiction and direction of the MAP within the Foundation reflected this wider dilemma. What were the responsibilities of MAP scientists for the social consequences of their work? By the late 1940s MAP scientists appeared confident that their work could generate numerous benefits for at least a segment of wealthy farmers, corporate food processors, and other corporate entities. But what were the responsibilities among scientists for others? The question of their responsibilities was complicated by even sympathetic observers. Dickey, once again, suggested their complicity in generating worsened social conditions for many other agriculturalists.

Among those who questioned the nature and scope of MAP activities was William I. Myers. Myers, a graduate and member of Cornell's faculty since 1918, had long worked with the Foundation. Since 1941 he served as a trustee with the Rockefeller Foundation's General Education Board. Although his trusteeship ended in 1957, he continued to advise Foundation officers on matters of policy, particularly with respect to the Mexican Agricultural Program.

In spite of the substantial benefits produced by MAP, Myers questioned whether greater returns in human welfare could be achieved through some alternative program. Without questioning the basic project to assist capitalist agricultural production, Myers questioned the wisdom of allowing MAP to benefit only those producers. Myers proposed instead

an essentially reformist program for the Foundation's mission in Mexican agriculture:

Regardless of the location of the agricultural program, in my opinion, it would be highly desirable to expand our work in Mexico to include research on economic and social problems of agriculture in addition to those of physical production. Remarkable achievements have been made by Dr. Harrar and his associates which already influenced the food supply of Mexico and will have cumulative beneficial effects in the years to come. However, the farm economy of that country is heavily handicapped by hundreds of thousands of uneconomic farm units that are too small even to provide subsistence for the families that are dependent upon them.[4]

Myers remarked that although the MAP benefitted agriculture, this followed a skewed distribution of benefits among different classes of farmers.

A more serious aspect in Myers' report questioned the emphasis placed on technological improvements in agriculture:

Furthermore, these small farms cannot make use of improved seeds, better methods of insect and disease control and improved agronomic practices because they have no surplus above family needs to sell to finance such improvements.[5]

In 1949 Myers spoke to Harrar during a visit to Cornell. Myers urged Harrar to promote sociological studies related to agricultural extension in Mexico. Specifically, Myers requested that Harrar allow Allan Holmberg, a sociologist specializing on Latin America, to use the MAP "as a sort of basis for operation." [6] Holmberg's studies, which had received support from the Carnegie Foundation, represented the kind of research that Myers hoped to include in the regular operations at MAP.

Harrar, however, resisted the expansion of MAP to include any professionals other than those narrowly focused around production techniques. As early as 1946 Harrar voiced doubts about the wisdom of "entering the field of the economic setting of agriculture." Harrar, without being more specific, referred to the use of economic studies as posing

"dangers to the program." Sociological studies held even less value to Harrar.

In 1949 Harrar wrote to Weaver concerning Myers' proposal that the MAP provide a base for conducting sociological studies. Harrar stated his reservations about facilitating the Holmberg study, while advocating the more restrictive program he had already constructed at the MAP. Harrar wrote to Weaver:

. . . I have no pronounced interest in expanding our activities to include the sort of project which Dr. Holmberg has in mind. . . . I think I made it clear to Holmberg that we did not contemplate entering the field of applied sociology . . . [8]

Even as Harrar succeeded in steering Holmberg's research away from Mexico and to Peru instead, members of the Rockefeller Foundation remained concerned about certain social dimensions that were bound to result from the Mexican Agricultural Program.

Social Science: An Abortive Beginning

In spite of the initial narrowing of the MAP's scope in the early 1950s, problems remained regarding the mission as constructed by Harrar and team. While certain scientists, such as Norman Borlaug, experienced encouraging gains among farmers in the adoption of commercial techniques others, such as Edwin Wellhausen, faced continuing difficulties. Various scientists recognized that something had to be done to spread techniques to a greater number of farmers if the mission were to endure.

In the early 1950s Dr. Joseph H. Willits, Director of the Social Science Division, commissioned Herrell DeGraff to investigate "the complex technical, social, and economic problems" involved in the Foundation's program to stimulate Mexican agricultural production.[9] DeGraff, who received his advanced degree in agricultural economics at the University of Chicago in 1941, worked as a consultant for the Rockefeller Foundation in 1949, 1952, and 1953. In subsequent years DeGraff served in various capacities as a spokesperson for the American livestock industry, including his presidency of the American Meat Institute in 1963.

DeGraff, during the summer of 1952, spent approximately six weeks traveling through a regions, primarily in the state of Mexico. DeGraff's report to the Foundation marked an interpretation of agrarian relations which, in spite of his naivete, influenced subsequent Foundation policies. DeGraff, in his report submitted to the Foundation, concluded that distances and means of travel were not the measures of Mexico's rural isolation and underdevelopment. Vastly more important, according to DeGraff, were the constraints that traditional culture posed for modernization. While these traditions possessed certain advantages for rural people, such as self-sufficiency, DeGraff argued that it was essentially the small, subsistence farms that had to be consolidated and transformed into commercial centers of production. Central to the rural problems that the Mexican peasantry constituted was the role of the ejido. DeGraff wrote the Foundation that it was remarkable that the ejidos performed as well as they did given "small allotments [of land], often very poor land, without building, without work stock and tools, without capital, and without credit." [10]

DeGraff could have counseled the Foundation to provision these agriculturalists with necessary elements for productive farming, but he did not. Instead DeGraff suggested a practice that conformed with diffusing inputs from the top down as others in the Foundation and the Mexican Agricultural Program had argued. DeGraff noted that the promotion among the sector of privately-held plots not only began with those agriculturalists more inclined toward commercial production, but that this received the implicit, if not active, support by various members of the Mexican elite (e.g., bankers, government officials, wealthy agriculturalists). Such a strategy conformed to and encouraged power arrangements that had arisen after the revolution and continually eroded the position of the peasantry. DeGraff justified this exclusion of most of Mexico's agriculturalists in the following words:

Few as they are, these farmers have an importance in the agricultural economy of the state [Mexico] vastly greater than their numbers would indicate. They have a different economic setting than do ejidos and minifundia, mainly lying in the fact that they are managed with commercial intentions. They are operated with a profit and loss account in mind--and operations are guided by the market place, by costs and returns, instead of by the

families' direct food needs. They are employers rather than suppliers of labor. And to a much greater degree they combine capital with land and manpower resources in an effort to get more efficient and profitable operations.

This is not to say that all these are progressive, efficient, and well managed farms, but they tend in that direction to an enormously greater degree than do the ejidos and tiny properties. The operators of these farms are mainly the ones who have quickly adopted the results of the DNSA (Division of Natural Science & Agriculture) program. They do not have the reticence to change their farming practice which characterizes the tradition-bound Indian. They read. They have their association through which they attempt to promote their group interests, and publish journals dealing with the special problems. In short, they are a group with similar motivations and aspirations to those of U.S. commercial farmers--and any good agricultural extension agent from this country, knowing their language and their local conditions would know precisely how to go about working with them. Better seed, fertilizers, pesticides, and specialized equipment are not to them foreign ideas of which they are suspicious. [11]

DeGraff noted that the kind of change he envisioned might contribute to social tensions in rural Mexico. These tensions represented the natural outcome of programs and policies that would foster the rise of a larger, more extensive class of commercial farmers. DeGraff, like Myers and others in the Foundation, echoed the need for additional personnel to be connected with the Mexican Agricultural Program in order to achieve "the most advantageous change in production with the least possible social and economic disruption."

DeGraff's study might first appear as just another sociological study to be rejected by Harrar and associates. Yet, the purpose behind DeGraff's proposal was the use of social scientists to accommodate the programs designed by natural scientists. More generally, this kind of social science reflected a new form of public administration in which the needs of men, in this case ejidatarios and minifundistas, would be subordinated to the plan of increased production. In concluding his report to the Foundation,

DeGraff outlined an auxiliary role that social scientists might play in the spread of agricultural technologies.

It seems to me that DSS (Division of Social Science) may now make two extremely important contributions to the over-all Foundation program in Mexico. The first of these is to contribute to the acceptance by farmers of the DNSA (Division of Natural Science & Agriculture) results . . . Secondly, DSS may contribute to answering the economic and social problems which surely will follow upon acceptance of improved biological practice in Mexican agriculture.[12]

By 1954 the Foundation initiated a new section within the MAP--the section on Agricultural Information. Paralleling DeGraff's recommendation regarding the dissemination of information, a major task of this section involved the spreading of information as a means of extending the practice of commercialized techniques. Delbert Myren headed the section, which emphasized written and film presentations.

Myren's work reflected an orientation that was also present in the work of influential academics in the field of communication development, especially Everett M. Rogers' major study, The Diffusion of Innovation. This approach assumed that one of the chief obstacles to development resulted from primarily the absence of information. Myren's job entailed, therefore, showing both professionals and peasants alike the advantages of commercial techniques developed by MAP scientists. The major channel for professionals were research bulletins (i.e., Folletos de Divulgacion) and a technical journal (i.e., Agricultura Tecnica en Mexico).

Part of the power of these written materials exceeded the merits contained in particular practices. Particularly with respect to Agricultura Tecnica, the form of the articles revealed a professionalism to instruct older tecnicos who did not receive the indoctrination that younger professionals experienced within the MAP or at the National Agricultural University at Chapingo. The articles presented a view of agriculture in which the major objects of research (e.g., crops, soil, etc.) stood isolated and remote from the social context. After the termination of the Foundation's mission, Agricultura Tecnica remained a major channel linking the research of Mexican scientists to current projects of their fellow professionals in the United States.

The other major channel for diffusing information to Mexican agriculturalists aimed at informal meetings of farmers to inform them of the latest practices. Following a pattern set nearly half a century before by Seaman Knapp, Myren sought potential demonstration sites. These were chiefly the showing of films at farm fairs and field days.

In what was one of this section's first, but also last of this type of investigations, Myren ascertained differences among the kinds of farmers who attended farm fairs versus field days.[13] The farm fairs represented occasions for agriculturalists within a region to gather together and exchange both information and goods. The field days, on the other hand, were orchestrated by the experiment stations and represented the dissemination of information in a downward fashion--from the expert to the farmer. In reviewing five regional farm fairs (Toluca, Guadalajara, Tehuacan, Tlaxcala, and San Luis Potosi) Myren discovered that these meetings tended to attract a much less educated strata of farmer. This, of course, represented a problem of how to best communicate novel techniques. In addition, Myren noted that in this group of poorly educated farmers (83 percent did not complete primary schooling), many worked their fields without benefit of mechanized equipment. "The figures would indicate rather clearly that in these specific areas presentations involving the use of tractors probably do not strike much response in 95 percent of the viewers." [14]

The implications of this single finding were important in several different ways for both the section on Agricultural Information and the MAP operations generally. First, the evidence of so many farmers working with draft animals signaled to MAP scientists a vital component in agricultural production that did not appear in the usual calculus of recommended practices. Second, an important center for reaching the poorer sector of farmer were the farm fairs. Perhaps most important of all was the fact that researchers stood to gain considerable information about farming not merely through dissemination of technical advice, but understanding the conditions under which Mexican agriculturalists labored.

In subsequent years, Myren gathered no further information about this group of farmers and reduced the role of farm fairs to the occasional presentation of a film or slide show. The importance of field days grew. Reports in Folletos and Agricultura Tecnica continued to emphasize the value of mechanized inputs with no mention of integrating the use of draft animals with recommendations for increased

productivity. While the MAP did seek information from farmers beginning in 1956, this occurred through a different office--the section Agricultural Economics.

In November, 1956 the Mexican Agricultural Program added a section on agricultural economics to its operations. Headed by Donald K. Freebairn, the section investigated "economic problems" in Mexican agriculture. "For the work of this program an economic problem will be considered to exist in any situation where the agricultural resources of individuals are being used inefficiently; that is, wherever a gap occurs between the existing use of resources and the optimum"[15] While this optimum stood as a kind of textbook fact, Freebairn quickly discovered various social problems intertwined in this concept.

Freebairn's first study examined the general problem of agricultural production in the Mesa Central and the Bajio. He described the principal problem of these regions as "the excess population engaged in agricultural production." [16] At the same time, however, Freebairn appeared to appreciate that there were few employment alternatives for these people and called for the development of more labor intensive agricultural enterprises. By the end of 1956 the agricultural economics section identified "the social and economic impact of extensive, commercial agricultural production in the tropics" as an area for further study.[17]

In 1957 Freebairn completed his study of small farm production economics: "An Economic Study of Commercial Farm Business in the Alto Rio Lerma Irrigation District." [18] The study represented one of Freebairn's first arguments of why to extend technical assistance to a greater number of farmers. The study, however, only encompassed those water users with holdings in excess of five hectares and where cash receipts averaged 50,592 pesos per year.[19]

In 1958 Freebairn conducted a similar investigation based on a study of poultry producers serving the Mexico City market. Again Freebairn urged more research be provided to "smaller" producers as a means of fostering agricultural development. The medium-sized poultry producers in this study had average production costs of 176,686 pesos annually.[20]

One of Freebairn's last studies for the MAP considered the position of Mexico's most populous group of agriculturalists--the ejidarios. While Freebairn's earlier reports

reflected a faith in basic free market mechanisms, the "Economic Study of Ejidal Agriculture in the Yaqui Valley"

voiced doubts about the existence of such a market for ejidatarios in Sonora, Mexico. While noting that ejidos in the Yaqui Valley failed to take an active part in farm management, Freebairn concluded that this resulted from larger problems: "These are problems which cannot be readily solved by the ejidatarios themselves. Their limited participation in the business of farming is in large part determined by a series of well established institutional arrangements beyond their direct control." [21]

Beginning in 1960 the Mexican Agricultural Program passed through a transition of several years from a national to an international research center. This transformation encompassed various changes and continuities in its mission to extend agricultural technologies globally. Since the early 1950s the Foundation had used its personnel and facilities in Mexico to initiate similar kinds of programs elsewhere in the world. First in Latin America and then in Asia and Africa. Foundation scientists expanded their research in Mexico to incorporate other crops and regions. With the formal end of the Mexican Agricultural Program in 1960, the Foundation's personnel continued their rapidly evolving international research through the reorganized Ministry of Agriculture.

The newly formed organization, CIMMYT, for the most part followed a simple strategy of expanding the projects used in Mexico internationally. While the history of the MAP is told as a unified experience, there existed important differences between the wheat and maize improvement programs. Beginning with the international programs, controversies arose among CIMMYT scientists concerning the proper design of agricultural development.

In the wheat program there emerged an approach patterned after the experiences gained in Mexico's Pacific Northwest. When Norman Borlaug traveled to countries in Asia, Africa, and Latin America he explained methods that replicated those first used at Ciudad Obregon, Sonora. Indeed, CIMMYT's international programs first encompassed only those experiences gained in the Mexican Agricultural Program's wheat research. The essence of this approach was capital intensive, high-yielding, production programs directed at farms with well-established commercial operations.

In contrast, the maize program continued to emphasize programs in Mexico and Latin America. While certain research examined applications for large-scale commercial production units, generally the maize program concentrated on the role of smaller agriculturalists. Ed Wellhausen emphasized the need to convert traditional agriculture into modern units.

While the two programs shared many similarities, such as the commitment to capitalist agriculture, there emerged points of contention during the 1960s. Central to this debate stood the role of the Third World peasant/proletarian. The wheat program suggested a policy of benign neglect coupled with the emptying of specific regions of 'excess' labor. Even as this approach took shape in various parts of the Third World, members of the Foundation and CIMMYT scientists questioned the wisdom that might result. Paramount among the early critics of this 'green revolution' was the concern that social tensions, perhaps even revolution, would result in the countryside.

The final reports submitted by Donald Freebairn in the early 1960s argued for the fuller integration of traditional peasant production into national and international markets. With the planning of the International Maize and Wheat Improvement Center in the 1960s went the task of identifying a program for transforming subsistence agriculturalists into the 'free' market. By 1970 the task of transforming peasant production resulted in dividing the previously cohesive community of scientists into antagonistic camps based on differences over agricultural policies. The Foundation reestablished consensus only through the reemergence of a social science division within CIMMYT and the elimination of political discussion.

Identifying a Rural Development Program

In 1960 one of the first recommendations directed to the Rockefeller Foundation regarding programs for rural development came from Dr. Allan Holmberg. Holmberg, along with others, contributed to a book written for the Council on Foreign Relations and its various officers, including David Rockefeller, as a means of influencing U.S. policies in technical assistance.[22] The Foundation also had opportunities to learn of Holmberg's work through colleagues, such as Kenneth Turk, who also taught at Cornell University.

Since 1952, after receiving no further support from the Rockefeller Foundation's Mexican Agricultural Program, Holmberg initiated a mission between Cornell University and the Peruvian government. The project integrated work in agricultural production, education, and nutrition. The project was located in the Peruvian highlands at a hacienda in the village of Vicos. The Cornell-Peru project at Vicos, in its own way, represented another model of agricultural development than that organized by the Mexican Agricultural Program. In addition to the combination of nutrition and agricultural production, Vicos offered a means for transforming traditional social relations.

The Vicos Project, according to Holmberg, involved a minimal amount of outside assistance. Along with himself, the project had only several other foreign experts and a limited link to national organizations. Although Holmberg emphasized the utilization of improved agricultural techniques, this rested primarily on improved seed and fertilizer.

The key to the Project's success stemmed from changes in productive relations. Holmberg wrote that the successes at Vicos came only after laborers were given an opportunity to control work:

The results of self-rule and self-reliance have been strikingly demonstrated at Vicos since 1957. In the first year after 'independence' production doubled, with a substantially smaller labor force. The year 1959 saw a further rapid improvement. With the increased resources now available to them the Vicosinos are taking up many new projects, this time completely on their own. They are improving access roads to get produce to market, working out better marketing and transportation arrangements and developing a better water supply. They are better fed, clothed, shod, and housed.[23]

At least as important as the change in techniques of production were altered political relations. For Holmberg the essential problem for the Peruvian subsistence cultivator was traditional political authority, particularly as this appeared in the person of the patron. The cultural isolation, lack of dynamism, stagnant levels of production, and other characteristics used to describe traditional cultivators, in Holmberg's view, resulted primarily from the historic legacy of powerlessness. Paralleling the kind of

description presented by Carl Sauer some twenty years before, the main obstacle to a variety of developments (e.g., agricultural production, nutrition, and education) were unequal political and economic relationships.

The most striking portion of Holmberg's proposal to the Council on Foreign Relations referred to the necessity of changing political and economic relations as a means of achieving development.

When the Cornell-Peru project first assumed control at Vicos, the making of decisions in most matters of secular concern was almost wholly vested in one individual, the patron, who was not a member of the Indian community. . . . The project was concerned with transferring power to the community, not with retaining it, as in the traditional hacienda system.[24]

Holmberg attested to the measure of success in this program by noting the adoption of new techniques by nearly all Indians in the project, with increased yields of 400 percent in some cases.[25]

At the same time as the Holmberg proposal, scientists who maintained the Foundation's program in agricultural research searched for a means of dealing with the millions of Mexican agriculturalists who had not yet benefitted from state expenditures on agriculture. The main proposal for confronting this problem, however, did not complement Holmberg's solution.

During the 1950s Dr. Wellhausen expressed the need to design programs to foster agricultural development among the smaller agriculturalists, similar to the recommendations that Freebairn later presented. This 'problem' nevertheless conformed to the pattern of solutions offered by the Rockefeller Foundation that attempted to work through existing institutions. In contrast to presentations by Sauer, Holmberg, and others, Foundation scientists limited the task to technical factors.

The idea that technical factors accounted for differences in maize and wheat production had an obvious appeal among MAP scientists. Sterling Wortman, who headed the maize unit from 1951 to 1954, argued that poorer performance in national maize production figures stemmed from problems within specific Mexican agencies as well as the misdirection of early programs at MAP.

As I look back I realize that in the corn program we primarily had a plant breeding effort under way, not a comprehensive production program of which plant breeding was a necessary part. We were concerned very much with the problem of developing the many varieties of hybrids needed for the great number of ecological situations in Mexico and we carried this program to the point of producing foundation seed for the National Corn Commission. We did not, unfortunately, measure our own progress by what happened to the national average yields of corn in Mexico.[26]

A major difficulty in Wortman's assessment, nonetheless, stemmed from the considerable control that Foundation scientists exercised over various agencies, including the National Corn Commission. Others, however, pursued the theme of technical barriers as the problem.

In the early 1960s, Delbert Myren explored in considerable detail the notion of technical factors explaining different experiences in the production of maize and wheat. Myren, first of all listed a number of features that suggested advantages in maize production. In yield contests conducted in 1957, for instance, Myren noted that maize yielded 15 tons per hectare, while wheat attained only 6.5 tons.[27] He also reported that corn could be successfully grown wherever farmers raised wheat. What is more, he cited empirical evidence demonstrating similar yields per hectare had similar cost functions.[28]

There existed, however, important differences. Support prices for the two differed in excess of 10 percent for various years in favor of wheat.[29] Myren discounted this factor and pointed instead to three major differences: locational, farmer type, and plant attributes. Myren noted that wheat required a greater amount of irrigation than did maize. Among agriculturalists, maize scientists were disadvantaged by having to reach millions of farmers in remote locations, whereas wheat farmers were relatively few and concentrated. The largest difference, according to Myren, arose from 'technical factors.'

Perhaps the most important explanations for the differential success of corn and wheat lie in the technical differences between the two crops.

First is the fact, already mentioned, that in the case of wheat there was a serious yield limiting factor, in the form of stem rust, that could be effectively removed by plant breeding, thereby offering a dramatic yield increase at practically no cost to the farmer through the use of new seed. A single yield-limiting factor of this type was not present in corn.[30]

Myren's description of technical differences gained currency among many of CIMMYT's scientists in spite of its substantial flaws. Myren's article included data that pointed to wheat successes as involving considerably more assistance than disease control. Wheat increases resulted from both direct and indirect subsidies. In the case of land, wheat production moved from "old" lands in the Bajio to "new" lands in the Pacific Northwest. In 1940, 43 percent of wheat harvests came from central Mexico; in 1960, 71.5 percent of this originated in the Northwest.[31] On top of this were higher subsidies to wheat, vast irrigation projects, corporate investments in agricultural equipment and supply, the support of producer associations, and agricultural scientists coordinating and assisting the increased production of wheat.

In place of the elaborate institutional structure that surrounded wheat production, MAP scientists decided not to foster a similar arrangement for millions of maize producers. Instead, Wellhausen and colleagues proposed research and techniques appropriate to those circumstances that farmers faced on small holdings.

Before additional land can be brought into cultivation, extensive research and education will be needed. Higher yielding varieties will need to be developed which can tolerate high temperatures, excessive rainfall at times alternated with drought, and which will have greater resistance to insect pests and plant diseases.

What about more production on land now under cultivation? With the proper kind of effort corn production can readily be doubled on most of the land now in production in Latin America. To bring this about, however, a number of things will have to be done. Varieties will have to be genetically improved in yield capacity, in resistance to drought

and other adverse climatic conditions, in resistance to diseases and insect pests.[32]

Wellhausen concluded that at least one major institution for international research should be established for the production of food in order to avoid facing grave consequences later.

By the late 1950s many of those tensions that Dickey and DeGraff anticipated as a result of MAP activities in Mexican agriculture appeared in the Mexican countryside. Some of the first signs of social unrest occurred with the growing membership of workers in 'outlawed' peasant unions. Responding to the deterioration of both conditions and sources of employment, many joined organizations such as the General Union of Mexican Workers and Peasants (UGOCM), which lacked official government sponsorship.

The UGOCM, formed in 1949, attracted a growing membership in the 1950s and 1960s, while at the same time using land invasions to call attention to the plight of rural people.[33] In 1957 the UGOCM staged an invasion of the Cananea Cattle Company, one of the largest private holdings in Mexico. Again, in 1958, the union organized thousands of peasants in simultaneous seizures of land in the states of Sonora, Sinaloa, and Baja California. In each of these regions the most important targets were large commercial operations--ones which owed their logic of production to the Mexican Agricultural Program.

Peasant activism spread during the early 1960s to other regions in Mexico. Ruben Jaramillo, for example, joined with five thousand peasants to invade pasture lands in Morelos.[34] In Chihuahua peasants intensified their efforts with the formation of guerrilla groups. Ramon Danzos Palomino led thousands of peasants in marches and land invasions throughout various states in central Mexico, including the considerable support by workers in Puebla. Between January 1967 and August 1968 at least a dozen land invasions occurred in Puebla.[35] In addition, rural workers displayed increasing electoral power, threatening the incumbency of Mexico's dominant party and its replacement with more radical elements.

While certain Foundation scientists, such as Edwin Wellhausen, had an acute awareness of these activities, he and colleagues placed increased emphasis on the use of both technical and institutional means to incorporate a larger number of farmers employing MAP techniques. At the same

time, other scientists and officers of the Foundation reaffirmed the need to limit the scope of scientific assistance to techniques alone. Arthur T. Mosher, an agricultural scientist and officer with the Rockefeller Foundation, reflected a seeming agreement among agricultural scientists and the division between science and non-science: "It should be clear that such a research program needs to be comprehensive and well integrated, bringing to bear competence in all specialized fields related to the problems it tackles (e.g., genetics, pathology, soils science, entomology). It need not, however, try to tackle a wide range of problems." [36] Mosher's statement reflected a belief that the program could be comprehensive, while avoiding other problems in agriculture. But could the community of agricultural scientists avoid these other problems?

Since the inception of the agricultural mission in 1943, the Foundation received various reports of additional problems that demanded its attention. Certain observers, Carl Sauer for instance, argued that the Mexican Agricultural Program's approach would worsen rather than help millions of subsistence farmers. Another source, John Dickey, raised similar concerns to officers of the Rockefeller Foundation. In the late 1950s Donald Freebairn again questioned the degree to which agriculture would improve according to MAP policies and techniques. Could scientists, in fact, help millions of subsistence producers through methods historically employed by MAP scientists? If such methods failed, to what degree were scientists prepared to extend their work to a wider range of problems?

In the 1960s Foundation scientists were reorganized with the termination of the Mexican Agricultural Program and the initiation of a new organization, the International Maize and Wheat Improvement Center (CIMMYT). One of CIMMYT's first undertakings represented a response to the various issues raised by Dickey, DeGraff, Myers, Freebairn, and Holmberg. This undertaking, the Puebla Project, represented a response to various observers, both inside and outside the Rockefeller Foundation, who insisted that agricultural scientists foster institutional as well as technical change. For the moment, as Foundation scientists expanded from a national to an international organization, questions regarding scientists' responsibilities for their work were postponed. In the 1960s, CIMMYT scientists would attempt to formulate answers adequate to respond to these issues.

CHAPTER VI--NOTES

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7

The Interim Period: Terminating MAP and Initiating CIMMYT

On January 1, 1961 the Secretary of Agriculture for Mexico and the Rockefeller Foundation mutually agreed to terminate the Office of Special Studies and the Institute for Agricultural Investigations. These two entities were now merged into the newly formed research unit--the National Institute for Agricultural Investigations (INIA). In a brief paper written for other Rockefeller Foundation staff members, Edwin Wellhausen explained the circumstances surrounding the closure of MAP:

A change had to be made. The O.E.E. could not continue indefinitely. It had accomplished a major share of what it set out to do, except build a strong wholly Mexican Agricultural Research Institution. Those of us who were on the ground floor worried and lost a great deal of sleep over this point. The ideal way to have made the transition from a highly efficient office of Special Studies under R.F. control, with almost complete autonomy and freedom of operation would have been through a gradual build-up of the old Instituto de Investigaciones Agricolas.[1]

Wellhausen explained that the objective of placing MAP trainees in the IIA did not prove possible. The best that the Foundation could do involved the creation of a new research organization led by Foundation scientists and their trainees.

Wellhausen noted that while the new organization incorporated, as opposed to merely excluding, scientists from the IIA, this did not present any real difficulties to the

Foundation's objectives. Indeed, this arrangement, according to Wellhausen, quite possibly facilitated the Foundation's plan to reorganize agricultural research in Mexico:

To me the future looks exceptionally bright. The positions of Director General, Sub-Director and Research Director in the new Institute are presently occupied by key men from the ex-O.E.E. Furthermore, as you go down the line you will find that the heads of sections in almost every case were key men in the ex-O.E.E. In addition, every key man in the program has the full backing and support of the Minister of Agriculture . . . In spite of its present defects, it is at a level many times higher than the old Institute and at a point which may have taken us years to reach through a gradual shift of good men from the O.E.E. to the old Institute. In one jump we got where we tried to go for years.[2]

The decision which now concerned Foundation scientists concerned what next to do.

The closure of the Mexican Agricultural Program in 1961 did not come as a total surprise to the Rockefeller Foundation. For the past ten years various Foundation scientists had planned for the eventual termination of the Office of Special Studies. When the Mexican Agricultural Program came to an end in 1961, the Foundation had already prepared for the continuation of its work, employing many of the same scientists who had served in Mexico since the early 1940s.

One of the first suggestions for expanding MAP scientists' activities internationally appeared in a statement prepared by J. George Harrar in 1951. Harrar outlined a program in which the Foundation would serve as a catalyst for reproducing its achievements in agriculture throughout the world.

It is conceivable that the type of operation which has been successfully carried out in Mexico and has extended to Colombia can be extended not only to other key Latin American countries but possibly that tremendous opportunities exist in such areas as India and the Philippine Islands and perhaps in Japan and at a later date in other Asiatic countries.[3]

Portions of Harrar's memorandum, within three weeks, reappeared in a paper authored by E.C. Stakman, Paul Mangelsdorf, and Richard Bradfield. In their paper, the scientists stated that the MAP represented an experiment that merited repetition in other countries:

There are many ways in which the Foundation could become more widely helpful in Latin America, but none that appears more immediately promising than that of exploiting on a wider front the success of its present agricultural activities. The Mexican Agricultural Program stands as a hub around which future developments can be built. The experience gained in Mexico and the pattern of operation developed there can and should serve for operations elsewhere. The Mexican program should serve as a training center not only for American scientists, later to be assigned to other countries, but also for young Latin Americans destined to return to their own countries.[4]

In the 1950s the Rockefeller Foundation advanced the practice of international programs. In 1950 the Foundation started a mission in Colombia patterned after the Mexican Agricultural Program. Operating from a semi-autonomous office in the Colombian Ministry of Agriculture, the Rockefeller Foundation drew on scientists who had served with MAP. In 1955 another such mission started in Chile. By the end of the decade the Foundation's personnel in the agricultural sciences worked with national ministries of agriculture at various countries in Latin America (e.g., Venezuela, Ecuador, Panama, Nicaragua), Africa (e.g., Nigeria), and Asia (e.g., India and Pakistan).[5]

In 1958 the Foundation created two instrumentalities for conducting its international program. These were the Inter-American Maize Improvement Program and the Wheat Improvement Program.[6] In 1960 the Foundation also entered into a partnership with the Ford Foundation to create the International Rice Research Institute (IRRI) in the Philippines. Each of these operations originated from the model developed by the Rockefeller Foundation in Mexico.

Just as the new operating units evolved from the pattern of the first one, so from the operating units as a whole have evolved three international programs which are still in their initial phases.

The first, an inter-American maize improvement program, . . . The second, a wheat improvement program, . . . The third, the International Rice Research Institute.[7]

Although the International Rice Research Institute proved successful from the start, the crop improvement programs in maize and wheat floundered. Part of this difficulty stemmed from the cooperative nature of these programs. They depended, quite simply, on the degree of cooperation arranged by host governments. Such cooperation often vanished in times of political upheaval. The Foundation arranged a tentative solution with the creation of a new partnership between the government of Mexico and the Rockefeller Foundation. In an accord signed on October 25, 1963 the President of Mexico, Lopez Mateos, and the President of the Rockefeller Foundation, J. George Harrar, created the International Corn and Wheat Research Institute.[8] The basic idea was to fuse the two crop improvement programs into a single organization with an international mandate.

The Foundation immediately encountered problems with the Government of Mexico concerning the operations of the International Corn and Wheat Research Institute (ICWRI). First, Mexican officials were reluctant to commit large resources toward an organization whose benefits went largely abroad. At the same time Foundation officers were no less reluctant in having to share the administration of the ICWRI with political appointees (i.e., the Mexican Secretary of Agriculture). In addition, the ICWRI posed problems for attracting other sources of international finance. Various potential donors remained uncertain of the Institute and its formal partnership with the Government of Mexico.

In 1966 the Mexican government and the Rockefeller Foundation agreed to restructure the ICWRI. On April 11, 1966 the Rockefeller Foundation established the International Maize and Wheat Improvement Center (or CIMMYT as it is commonly referred to).[9] The formal administration of the Center rested with an International Board of Trustees. In fact, those named as Trustees remained controlled by the Rockefeller Foundation and only gradually included the interest of principal donors. The list of Trustees included representatives from the Ford and Rockefeller Foundations, which together furnished the largest portion of finances for the Center from 1966 to 1971.[10] Other trustees included agricultural scientists who had worked with the Foundation in one or another project (see Appendix D).

For the most part, however, CIMMYT's organization differed little from its predecessor--the Mexican Agricultural Program. Various scientists who had served in MAP during the 1940s and 1950s, in 1966 regrouped at CIMMYT. Edwin Wellhausen, who had joined MAP in 1944, became CIMMYT's first director general. Norman Borlaug headed the wheat program after having served with the MAP since 1945. Other MAP scientists who reappeared at CIMMYT in its first year included: E.C. Johnson, Reggie Laird, and Robert Osler. The headquarters for the first several years operated from the same two locations in Mexico City and Chapingo which MAP personnel had used in prior years. In addition to work in maize and wheat, CIMMYT scientists continued research on other crops with which they had worked in MAP (e.g., sorghum, barley, forage, etc.).

An immediate priority for both the Ford and Rockefeller Foundations concerned how to attract funding from additional sources. The Foundation's representatives agreed that in order to promote not only CIMMYT and IRRI, but also additional international centers, it was necessary to obtain sums of funding that exceeded their long-term capabilities. While each Foundation financed the early operations, both recognized the importance of gaining support from other sources. For CIMMYT, two potential sources were the United States Agency for International Development (USAID) and the United Nations Development Program (UNDP). In order to obtain funding from these sources, however, CIMMYT scientists had to involve themselves in programs which differed significantly from those activities they had conducted in Mexico during the 1940s and 1950s.

During the mid-1960s a primary emphasis among national and international agencies was projects designed to foster more popularly based developments than had occurred in preceding decades throughout the underdeveloped world. For U.S. agencies a primary focus for development programs followed the hemispheric policies initiated by John F. Kennedy and the Alliance for Progress. International organizations responded to calls for developments in more remote regions that had gained little from urban-based industrial development projects of the 1950s. Both national and international bodies in the mid-1960s focused on the promise of rural development schemes. For various national and international agencies the newly created CIMMYT represented an organization that possessed obvious talents needed to conduct a rural development project.

CIMMYT, following Edwin Wellhausen's leadership, pursued a policy of attracting national and international funds by quickly drawing together a scheme for rural development. CIMMYT scientists, because of their familiarity with Mexico, looked for a site in the central part of that country. Here were concentrated the greatest number of agriculturalists, millions of whom subsisted in marginal farming conditions. CIMMYT scientists had, in 1966, the opportunity to demonstrate that the techniques they had employed in the Pacific Northwest were applicable to this other class of cultivators.

Wellhausen, in fact, possessed many years of experience and interest in contributing to subsistence producers. Although he worked extensively in the design of maize production for use in capitalized production units (e.g., large family farms or contract farming for agribusinesses), Wellhausen also promoted agricultural research appropriate to conditions faced by less wealthy farmers. The problem-solving which Wellhausen identified as necessary for stimulating agricultural production among a larger group of farmers contained two elements. First, CIMMYT scientists, according to Wellhausen, needed to identify the technical barriers to increased production. Reggie Laird, for example, in 1965 researched maize varieties that performed well under conditions of drought or irregular irrigation.[11] Wellhausen and Laird, along with certain associates, believed that scientists could make important contributions over traditional methods of farming. Second, Wellhausen recognized that the institutional structure traditionally afforded little assistance to subsistence producers. Wellhausen believed that the support which had been given by MAP scientists to wealthy agriculturalists and their patronatos in the 1950s, in the 1960s had to be complemented with efforts by CIMMYT scientists to assist and organize less wealthy farmers.

Wellhausen's approach to improved agriculture corresponded neatly with that advanced by USAID, UNDP, and other agencies sponsoring international development. Common to this perspective was the notion that development could be planned and programs initiated whereby the lower classes would gradually comprise a new middle class. The goal of improving social conditions was wedded, moreover, to political objectives. The statements by Stakman, Bradfield, and Mangelsdorf addressed the political problem which they understood might be solved by research in agriculture:

The problem of food has become one of the world's most acute and pressing problems; and directly or indirectly, it is the cause of much of the world's present tension and unrest . . . Whether additional millions in Asia and elsewhere will become Communists will depend partly on whether the Communist world or the free world fulfills its promise. Hungry people are lured by promises, but they may be won by deeds. Communism makes attractive promises to underfed peoples; democracy must not only promise as much, but must deliver more.[12]

These three advisors to the Rockefeller Foundation stressed the necessity for producing adequate amounts of food as means of maintaining a political order that harmonized with capital production. There was no question but that the purposes of increased food production constituted a means for supporting social systems complementing the United States.

In the early 1960s Edwin Wellhausen traveled throughout Latin America proposing that governments encourage a greater participation among small-scale agriculturalists. Wellhausen, following the scenario described by Stakman, Bradfield, and Mangelsdorf, presented papers before agricultural scientists, government ministries, and business groups arguing for the creation of progressive development projects. The following excerpt typifies the kind of message that Wellhausen delivered before many of these groups:

In the next twenty years it will be decided if all of you will live a chaotic life or within a society that is progressive and advanced. This will depend on how rapidly you can accelerate food production and how rapidly you can incorporate into commercial production the vast proportion of economically viable subsistence producers.[13]

Sufficient food represented a political imperative.

Wellhausen recognized at the same time, however, that many private producers perceived little incentive for producing food. Greater profit frequently existed with the production of more exotic, export crops. Wellhausen proposed, therefore, a reform measure for meeting both increasing food needs and sustaining private profits. This reform measure demanded that governments sponsor public programs to spawn a commercial sector among subsistence producers to meet national food needs. Wellhausen noted that the promotion of

this type of development project had the advantage of increasing supplies of basic foodstuffs, to stabilize social demands, while not affecting export crops (e.g., coffee, sugar, cotton), thereby sustaining private profits.[14]

Wellhausen's approach also provided a means, as previously stated, for gaining the attention of potential donors' long-term financial support. CIMMYT now pursued a dual development approach. One side, the wheat program, continued research tailored to meet the needs of highly capitalized agriculturalists. In the early 1960s Borlaug sponsored programs in India, Pakistan, Morocco, and other countries which largely replicated his experiences in Mexico's Pacific Northwest. On the other side, in the maize program, Wellhausen and associates constructed plans to allow for greater participation among those farmers who had yet to benefit from advances in science-based agriculture.

In 1967 maize scientists prepared to demonstrate a rural development project organized by Wellhausen, Laird, and a team of CIMMYT (as well as national) scientists. After considering potential sites in several Mexican states, scientists agreed upon a region in the northwest portion of Puebla. Scientists proposed "to develop, field test, and refine a strategy for rapidly increasing yields of a basic crop on small holdings." [15] The region included approximately 80,000 hectares and 57,000 farmers. The basic strategy derived from that addressed earlier by Wellhausen, i.e., to foster the commercial production of maize among subsistence producers.

In the first year project staff (i.e., CIMMYT maize scientists, INIA scientists, and researchers from Chapingo) outlined what they regarded as the major obstacles to commercial production. The staff identified six obstacles around which they organized their problem-solving: (1) communication to farmers of new practices, (2) agronomic inputs located at accessible points, (3) crop insurance, (4) establishment of favorable relationships between input costs and crop values, (5) production credit, and (6) production linked to stable prices and accessible markets.[16]

In 1968 the staff emphasized problem-solving in terms of technical barriers. This problem solving focused on relationships between different maize varieties and distinct environmental zones within the project. Twenty field experiments measured different applications of fertilizer rates

for different soils and plant populations.[17] Another thirty-five field trials identified higher yielding varieties.[18] By the close of 1968 CIMMYT scientists concluded that the pilot study could now be expanded throughout the region. Depending on rainfall, soil properties, and levels of production, scientists stated that maize yields might be increased by 100 to 400 percent.[19] The two years of study and experimentation produced an optimism among scientists that appeared in a report outlining expectations for accelerated maize production:

Efforts to establish close coordination among agricultural institutions in the area, the team of agronomists working in the project, and the farmers have been very successful. This makes it highly probable that improved maize production practices can be rapidly extended throughout the area. It can be reasonably predicted that average maize yields in the area can be doubled by 1972.[20]

In 1969 the project staff pushed to extend the project, beyond experimental plots and demonstration sites including only several hundred farmers, to include thousands more farmers. The project staff confronted the first of a number of institutional and social problems. With approximately 3,000 farmers, local sources of credit agreed to provide only 4.9 million pesos of the 7 million which CIMMYT requested.[21] The reasons for tight credit at Puebla are not clear, but likely resulted from the low levels of repayment among smaller farmers as well as opportunities for greater profit in other kinds of loans (e.g., industrial). CIMMYT scientists responded to loan representatives' hesitancy by organizing farmers into credit societies to ensure repayment. While CIMMYT expounded the virtues of organizing farmers to solve common problems, the major reason for the credit societies derived from a requirement demanded by financiers: "the fact that most small holders, on an individual basis, cannot provide the guarantee required by the credit agency." [22]

The credit societies constituted, in their own way, a novel form of political organization. Unlike past programs where unrepaid loans became the province of a local bank or government official, the CIMMYT sponsored credit societies created a situation in which members policed one another. A CIMMYT publication on the Puebla Project described how this system worked:

When one or more members of a group fail to repay their loans, the rest of the group takes action to assure repayment . . . In some groups, if a member fails to pay because of irresponsibility, the group takes firmer action to liquidate this debt . . . One group, after trying to convince three irresponsible members to repay their loans in 1972, took the extreme measure of putting them in jail.[23]

Participation in the project required not only using practices recommended by CIMMYT, it also organized farmers according to institutional rules over which they exerted little, if any authority. In 1974 CIMMYT reported as a major achievement in the project that for the four major lenders (Impulsora de Puebla, National Ejidal Credit Bank, National Agricultural Credit Bank, and Agricultural Bank of the South) the annual repayment rate exceeded 90 percent.[24]

Although CIMMYT organized farmers to be accountable to private lenders and government agencies, it provided no mechanisms by which participants could control these institutions. One demonstration of organizing farmers to follow and not lead institutions occurred with the agricultural insurance agency of ANAGSA. To farmers who risked considerable sums in order to follow practices recommended by project staff, insurance was important. Yet, as reported by a consultant to the United States Agency for International Development (USAID), NAGSA provided little assurance to participants.

The performance of the agricultural insurance agency has long been a bone of contention between project participants and Puebla staff. The farmers complain ANAGSA premiums--which are a requirement to receive credit--constitute a rip-off because the agency seldom makes good on reimbursement of crop losses except when a total disaster occurs. Since farmers customarily operate holdings scattered in multiple plots physically removed one from another, they in effect are insuring themselves against total disaster. By 1974 rural dissatisfaction with crop insurance had already grown from a trickle to a flood; late in the year, the Valley of Puebla was severely ravaged by hailstorms that caused widespread damage to the harvests of project participants.[25]

In spite of these complaints, the project staff did not attempt to redesign ANAGSA policies according to participants' needs.

In contrast to original goals that referred to institutional, as well as technical, problems needing to be solved, USAID consultants cited CIMMYT as imposing a bureaucratic structure. Their consultants reported that, "Quality of service to project participants--both by Puebla staff and other institutions--has been paternalistic, careless or needlessly mired in bureaucratic procedures." [26] Farmers were organized and made to accept institutionalized standards of when to plant, what to plant, how to plant, and, perhaps most importantly, who to cooperate with in order to plant. Unlike subsistence producers who operated with some independence, participants learned to follow rules.

For those participants who followed CIMMYT recommendations there were frequently substantial rewards. CIMMYT scientists reported that incomes for participants increased 23.8 percent from 1967 to 1970 and argued that much of this resulted from the Puebla Project.[27] The report also stated that by 1973 slightly more than 7,000 farmers participated in the project.[28] The project also influenced and benefited many others, who obtained credit privately and worked independent of the project while employing recommended methods.

At the same time that CIMMYT gathered information to follow general changes in the region, these data provided little impetus for evaluating feedback. The USAID consultants pointed once again to a situation in which CIMMYT appeared to be fostering relationships between farmers and institutions irrespective of social consequences.

Lack of coordination between Puebla staff of different program components--for example, researchers with promoters, or evaluators with either--has long been a problem endemic to project operations. Competition, friction and other problems of communication between the staff of the project and that of other cooperating institutions have often escalated to the point where Plan Puebla's continuity could be jeopardized.[29]

Particularly important in their report were relationships between those who conducted evaluations of the project and those who designed it. In two major reports about the Puebla

Project published by CIMMYT, there is a complete absence of consideration concerning anticipated consequences for non-participants.

By 1973 the project had not met its own goals of doubling production. Participants produced approximately sixty million kilograms of maize on about twenty thousand hectares of land.[30] CIMMYT calculated that recommended practices accounted for approximately one-third of this increase or almost twenty million additional kilograms of maize.[31] Non-participants, numbering at least forty thousand farmers, produced one hundred and thirty-two million kilograms of maize on probably no less than sixty thousand hectares.[32] Although CIMMYT projected that within ten years approximately 60 percent of the region's land would employ improved practices, it provided no statements regarding how many farmers this might include.[33] The concern among CIMMYT scientists appeared to be limited to aggregate maize production levels. Beneath statements that gave little evidence of concern for the nonparticipants, however, were disputes among CIMMYT scientists. These disputes focused on the responsibilities of scientists for general social conditions.

The monitoring and evaluation of the Puebla Project appeared from the start a contentious element. From 1967-1969 evaluations focused on technical elements and were constructed on an ad hoc basis. In 1969 Heliodor Diaz, employed at Chapingo and completing a doctoral dissertation at the University of Wisconsin-Madison, assumed direction of evaluations for the Puebla Project.[34] Diaz placed emphasis on institutional constraints that prohibited a greater number of farmers from adopting improved practices. Diaz and Reggie Laird were both familiar with another independent evaluation being conducted in the region by a Mexican sociologist, Luisa Pare. Pare's analysis indicated that numerous problems, including limited adoption rates, resulted from participation limited by political allegiances.[35] Pare described a situation in which the wealthy class of agriculturalists, bankers, and politicians governed participation. Pare noted particularly those agriculturalists who were politically active in organizations without official sanction (e.g., peasant leagues such as the UGOCM) were denied credit or other inputs. She also cited examples of nonparticipants as comprised of agriculturalists who challenged the land or water rights of those possessing large-scale operations. Pare argued that so long as CIMMYT dismissed this social context (which guided institutions and limited participation) the project would bypass the majority of agriculturalists.

Although neither Diaz nor Laird accepted Pare's claims uncritically, her report persuaded them that technical and institutional aspects of the project were insufficient to obtain greater levels of participation.[36] Pare, unlike Diaz and Laird, believed that no genuine development could occur until the vast numbers of subsistence farmers, migrant laborers, and unemployed questioned the political and economic institutions that limited their participation. Diaz, Laird, and Wellhausen believed that institutional changes could help farmers in Puebla, Latin America, and the underdeveloped world.

In 1970 CIMMYT organized an international conference at Puebla, Mexico, to discuss opportunities for increasing agricultural production on small holdings. Director General Wellhausen opened the meeting calling for the expansion of programs to assist subsistence producers. Wellhausen argued:

- 1) It is urgent to extend the new science-based technology to the subsistence farmer for purely humanitarian reasons.
2. It is urgent to increase the production of the subsistence farmer because it is doubtful that the present commercial farming sector alone will be able to produce the food to keep pace with the current rate of population.
- 3) Production increases are urgent to prevent a possible social upheaval.
- 4) It is urgent to increase the production of the subsistence farmer to facilitate rapid, orderly, and overall growth of the developing nations.[37]

Wellhausen's address before participants representing USAID and the World Bank constituted a petition to expand the Puebla Project on a global scale. Wellhausen repeated that the incentives for such programs could not be approached simply on the basis of profitability. His third and fourth points reaffirmed that agricultural scientists must be responsive to social needs, not merely private profits.

At the conference three agricultural technicians from El Salvador spoke about their experiences in promoting co-operatives. The technicians told of several projects in El Salvador which followed CIMMYT's Puebla Project model. They spoke of how, in a country where approximately 10 percent of the farmers typically possessed 80 percent of the land,

technicians could not 'induce' the remaining 90 percent to adopt improved practices. One technician responded to a question by an unidentified participant regarding the nature of constraints faced by subsistence producers:

Question: As a point of interest in line with this same problem, a device in the credit organization here in Mexico has been the creation of solidarity groups [credit societies] . . . Are there any objections to such an approach and what can be done to overcome them?

Response: Yes, it is unfortunate that in El Salvador and perhaps other countries in Latin America, when we try to solve problems of small farmers, not in a religious or political sense, but with good intentions and awareness of our national needs we are looked at with skepticism by the government. We are convinced we are working for the benefit of the people. However, the response of the private sector, and even the government, would make it appear that they are interested in keeping the farmers in poverty at their present low levels of subsistence.[38]

The situation of subsistence farmers and the institutional practices limiting their participation in El Salvador mirrored that which occurred at Puebla. Local government and business interests often encouraged improved agriculture for a class which already held economic and political power. The technician's response revealed an essential tension in Puebla-style projects. In order to solve problems which subsistence producers faced, technicians frequently focused increasing attention on institutional and not merely technical barriers. A technicians to the degree that they fostered popular participation, from the perspective of the local elite, frequently appeared to be disrupting social and political relations. The technicians' misgivings about their project in El Salvador reflected a confusion regarding the meaning of agricultural improvement. If productivity increased but the standard of living for many changed little at all or worsened, how were they to evaluate their own performance?

For other conference participants, however, there existed little confusion regarding the standards of success in

Puebla-style projects. Another participant at the conference, Simon Williams, provided another image of Puebla-style projects. Since 1966 Williams, a professor with the Harvard Business School, worked with USAID in a project at Jalisco, Mexico. There he headed a project to accelerate production on "small farms traditionally of low yield, in order to sharply and quickly increase land productivity, crop quality, and farmer income." [39] Williams acknowledged that the prototype for this design came from collaboration with CIMMYT scientists. He noted, in a report to USAID, that the new organization of farmers represented "a new type of land based agri-industrial corporate complex, financed by off-farm, national and international (particularly U.S.), sources of money and management . . ." [40] The prototype of farmer organization would, Williams added, "take full advantage of existing tax laws in the interest of U.S. investors." He interviewed representatives of those interests "most relevant in operational terms" to the prototype, which included advice from Insecticidas Ortho, International Chevron Chemical Co., DuPont, Industria Quimica Pennsalt, Productos Del Monte, Cynamid de Mexico, General Foods de Mexico, Heinz de Mexico, Diamond Chemicals de Mexico, Mobil Chemical International, Campbell Soups de Mexico, Monsanto, Corn Products Corporation, Anderson Clayton de Mexico, La Hacienda (International Milling Corporation), and the Ford and Rockefeller Foundations. [41] Nowhere in his consultations appeared the names of groups who represented peasant leagues, industrial and agricultural workers, migrant labor, or the unemployed.

The Jalisco project promised, like the Puebla Project, to produce 15,000 to 20,000 metric tons of corn, without mention per what unit of land. In addition to direct sales into the open market, Williams envisioned expanded corn grain and silage tied to milk and meat production. Williams explained how he foresaw the prototype operating:

The logical extension of this line of thought, then, is to get the prototype into action, demonstrate the viability of one new way to employ private enterprise to accelerate agricultural development and deal with complications of success as a second stage of the project. To get action means to get capital. To get pioneering capital means to maximize profit. To maximize profit, means, among other things, to market in the simplest, easiest way. Should this mean that benefits of efficiency

be returned almost in their entirety to the stockholders, with little being yielded in terms of lower price to the ultimate consumer, then such may be the price of getting a model built. While this may also mean the deliberate introduction of imperfection into the model, surely this is not a vital flaw. This is correctable. Without the model, there is nothing to correct.[42]

Williams' notion of the purposes behind rural development departed radically from the rationale that Wellhausen had employed as a major underpinning of the Puebla Project. For Wellhausen the specific purpose of Puebla-type projects had been to alleviate conditions of unequal development. Wellhausen promoted the Puebla Project not simply in terms of increased production, but increased participation among those farmers who were bypassed in earlier developments. For Williams the generation of benefits which were to be "returned almost in their entirety to the stockholders" postponed the problem of unequal development. Wellhausen, Laird, and certain fellow scientists worried if this postponement was not further encouragement for institutions to permanently exclude 'nonparticipants' in Puebla, Jalisco, and elsewhere.

Whether the development model at Puebla could be further reformed to reflect Wellhausen's concerns for greater participation or Williams' emphasis on agribusiness profits depended in large part on how potential contributors responded to either model. In closing remarks delivered at the Puebla conference, the World Bank Director for Agricultural Projects, L.J.C. Evans, asserted the willingness of the World Bank, FAO, and UNDP to fund further research by international agricultural research centers. Evans explained that while the bank had an interest in future projects like the one at Puebla, these required the support of local institutions. The key institution necessary for the success of Puebla Project prototypes was the bank, whether local or international:

I would like, before concluding, to say something about the involvement of private sources of finance to which Dr. Williams referred. This is of high importance because the public sector and public agencies by themselves are not going to be able to provide what is wanted, nor should they be expected to do so. I think we have to find ways

to show the private commercial banks it may pay to invest their money in agriculture, even when farm holdings are small.[43]

From Evans' perspective, it was particularly the commercial success of rural development that determined potential donors' degree of support.

From the Rockefeller Foundation's perspective, the Puebla Project constituted a successful program in attracting greater financial support. In 1969 CIMMYT received its first additional grant, amounting to \$425,000, from the U.S. Agency for International Development.[44] In 1970 it gained funding from the United Nations Development Program.[45] And by 1972 CIMMYT received donations from USAID, UNDP, World Bank, Inter-American Development Bank, and the governments of Zaire and Denmark.[46]

Beginning in 1968 the Rockefeller Foundation sponsored meetings at Bellagio, Italy with representatives from various international agencies. After a series of meetings, the Foundation generated a plan for three United Nations organization (i.e., IBRD, FAO, UNDP) to sponsor the network of international agricultural research centers. In 1971 the network resulted in the creation of a permanent secretariat: The Consultative Group on International Agricultural Research (CGIAR). By 1983 the CGIAR supported thirteen international centers with contributions that exceeded \$100 million.

The Puebla Project generated other changes in addition to an enlarged research organization. The project also fostered divisions within the Foundation's community of scientists. For the first time in the history of MAP and CIMMYT scientists entered into serious disagreements concerning their mission. The project, which on one hand created a basis for international support, also provided a basis for dissection among scientists.

In the early 1970s CIMMYT and sister institutions became the subjects of considerable criticism. Many of these critics focused on the social consequences surrounding programs designed to stimulate increased agricultural production. Observers of projects, like the Puebla Project, contested outcomes which helped only a limited number of agriculturalists. In spite of these observations, critics remained unable to specify precisely what CIMMYT scientists did wrong. The various reports, like that constructed by Luisa Pare, appeared to many readers as attacking the social

context in which scientists worked but over which they exerted little or no control. The accumulation of greater data on innovations sponsored by CIMMYT revealed little about how scientists interacted with this social context.

Events pertaining to differences among members of the community provide, however, a unique insight regarding criticisms of work performed by Rockefeller Foundation scientists since the 1940s. The disputes that arose from the Puebla Project constituted an occasion for exploring relationships between science and society. The nature of those disputes and their eventual resolution reveal basic commitments among CIMMYT scientists.

CHAPTER VII--NOTES

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The Resolution of Conflicts

In 1905 Frederick Gates wrote John D. Rockefeller, Sr. a letter which contained the original motivation for the creation of the Rockefeller Foundation. Gates mentioned "scientific agriculture" as the first field in which the great philanthropic trust should operate.[1] From 1906 to 1914 the General Education Board invested nearly one million dollars in a pioneering agricultural program of farm demonstration.[2] The International Education Board worked actively in agriculture from 1923 to 1929.[3] In 1943 the Rockefeller Foundation sponsored a mission in technical assistance with the government of Mexico. By 1983 the Rockefeller Foundation had fostered the creation of a network of international agricultural research centers that influenced the practices of millions of agriculturalists in nearly every corner of the world.

During the twentieth century the Rockefeller Foundation sponsored the spread of agricultural science as a means for meeting its self-appointed task--"to serve the welfare of mankind throughout the world." The promotion of science, in contrast to other endeavors, seemed ideally suited to meet this obligation. Yet to comprehend more fully what this commitment meant it is necessary to consider a question such as that posed at a Foundation staff meeting in 1930: "Is it fair to assume that any contribution to knowledge contributes to the well-being of mankind?"[4]

The Foundation during the first years of the Mexican Agricultural Program answered this question implicitly. At the same time that it supported Stakman, Bradfield, and Mangelsdorf's identification of problems in Mexican agriculture, it discouraged others from working on the problem that Carl Sauer identified in the countryside. The Foundation's

officers and scientists adopted the stance that their work answered adequately those criticisms posed by Sauer. The essence of their answer was that social problems were to be solved by increased productivity.

In 1951 Foundation scientists constructed a more explicit framework in describing how science-based agriculture had solved social problems. J. George Garrar submitted a memo in June 1951 marking one of the first occasions that the Foundation explained the primary social benefit derived from scientific agriculture:

It is axiomatic that a well-fed world is a peaceful world and though an oversimplification of the fact, it may be stated that much of the conflict which has occurred in the world during the past decades has been the result of population pressures in certain areas. These pressures have been due to an increasing population without a comparable increase in food production and have resulted in a struggle to secure more land and a greater food supply in order to maintain a satisfactory standard of living. If through the application of modern agricultural science world food resources could be increased and at the same time natural resources protected, much of the unrest which is currently manifest might disappear.[5]

In that same month Stakman, Bradfield, and Mangelsdorf reiterated Harrar's view, stating: "Hunger is a powerful enemy of peace." [6]

Stakman, Harrar, Bradfield, and Mangelsdorf conceived of agricultural science as a potentially humanitarian device for alleviating hunger. At the same time, this commitment to human welfare appeared mixed with other goals. Each of these scientists, for example, emphasized meeting hunger as a means for maintaining political order. Each explained that hungry people represented potential recruits for communism: "In this struggle for the minds of men," they explained, "the side that best helps satisfy man's primary needs for food, clothing, and shelter is likely to win." [7]

Another concern of these scientists referred to the benefits of food production for building economic progress: "People who are well fed are usually more efficient, vigorous workers. As the efficiency of agriculture is improved, more workers can be spared for making other needed improvements in transportation, manufacturing, sanitation, housing,

clothing, education, etc." [8] Paul Mangelsdorf, in a separate memo dated November 1951, submitted to Warren Weaver that the basic program for increased food production was aided by the Foundation's support of corporate initiatives in the world: "PCM is more than ever convinced of the need for private enterprise in connection with this great problem of bringing food, health, and education to the backward parts of the world." [9]

In the 1950s MAP scientists demonstrated that for particular regions (i.e., the Bajio and Pacific Northwest) they could make impressive contributions to national agricultural production. In 1958 Norman Borlaug, for example, boasted that MAP scientists had tripled national wheat production and nearly doubled yields per hectare since 1945. [10] At the same time he referred to "carry-over" as the implications contained in greater wheat production. [11] He reported that two major carry-overs were sharp increases in land values and the demand of cash for rentals instead of a "share-of-the-crop." Borlaug noted the positive nature of such carry-overs: "With such large investments [necessary for science-based agriculture], cash rentals are obviously more desirable than share rentals." [12]

Borlaug's perception of carry-overs reflected a notion common to many of his colleagues; i.e., increased profitability in farming operations marked the most important, if not only, measure of social consequences in agriculture. But what were the implications of such carry-overs for farmers without credit, share-croppers, laborers, or the unemployed? The science with which Borlaug and many of his colleagues worked provided little answer to these questions. At the same time, efforts to learn and better evaluate the nature of these consequences were stymied by agricultural scientists.

One of the few departments within MAP which did not reappear in 1966 at CIMMYT was economics. Economics within MAP, as headed by Donald K. Freebairn, raised troublesome questions for agricultural scientists. Freebairn, instead of simply measuring the value of agricultural output, questioned the social consequences that flowed from the spread of agricultural techniques. Freebairn's questions sometimes brought him into conflict with agricultural scientists, who perceived in them little value and potential harm. A.H. Moseman, head of the Rockefeller Foundation's agricultural research division, illustrated this conflict in response to

Freebairn's request to attend the Second Latin American Seminar on Land Problems in 1959.

From the outline presented in the memorandum of November 9 to you from Dr. Freebairn, it appears that considerable emphasis at the meetings in Montevideo will be placed on problems of land reform and tenure. We appreciate the importance of these problems in the Latin American countries, but it would seem desirable for members of our staff to avoid becoming directly involved in these fields in a manner that might impair the effectiveness of our cooperative activities. We, of course, have substantial opportunities to contribute to less controversial areas in fields of economists related to production, marketing, etc.[13]

The implication was that while certain brands of economics complemented Foundation policy, there existed other 'gray' areas of inquiry that might disrupt prevailing notions of agricultural research.

The questioning of MAP-sponsored agriculture as sufficient in "serving the welfare of mankind" soon surfaced elsewhere in the Foundation's scientific community. This questioning first appeared among MAP maize scientists who wondered why wheat had achieved such successes in Mexico, but maize had not. For many maize scientists, explanations of technical differences between the two crops did not adequately answer what many increasingly regarded as an essentially social problem.

In 1963 Wellhausen delivered a paper before the Sixth International Congress of Nutrition. While praising the achievements of the Mexican Agricultural Program, Wellhausen argued that much remained to be done to assist the millions of subsistence agriculturalists in Latin America. Wellhausen, in contrast to his colleagues (especially in the wheat program) argued that the problem of solving current problems were related to historic events. Wellhausen described this historic context as having shaped the contemporary problem of food production:

This situation is still further aggravated because in many of these countries food production is committed to the poorer lands. In countries where large land holdings are possible, the better lands are frequently held by the relatively few, more

fortunate individuals who produce mainly cash crops such as cotton, sugar and coffee for export. In such areas the subsistence farmers are forced to push their maize and bean patches to marginal areas, usually up the sides of mountains, destroying forests and water resources in an attempt to grow enough to eat.[14]

Wellhausen's remarks broke from a portrayal in which MAP scientists typically explained low productivity as the absence of sufficient skills or techniques possessed by subsistence farmers. Instead, his remarks gave credence to the notion that the major constraints faced by farmers were social, and not merely technical.

At the same time Wellhausen argued that driving more people off of the land did not represent an adequate answer for solving "major socioeconomic problems." [15] While arguing that the solution must begin with science-based agriculture, he also noted that initiatives by scientists and government officials were probably not sufficient to advance a production and raise standards of living for the poorest classes. He noted, in addition to population control, that the situation of agriculture in Latin America remained largely controlled by the wealthy: "The rate at which progress is made will largely depend on how fast the top thin layer of more privileged society in this vast area will take the initiative in providing the above essentials." [16]

Harrar, within three years of Wellhausen's statements, presented a vision of progress based on alternative social commitments. In 1966 Harrar echoed Mangelsdorf's notion of an agricultural science wedded not simply to increased production, but an organization characterized by the economic options common to multinational agribusinesses.

Frequently the scientists speaks with confidence of what could be accomplished in assuring adequate food supplies for all if given opportunity and sufficient support. And there is little doubt that these predictions could be made good under appropriate circumstances. But it is these circumstances that are critical, and the most basic of them is full support to the agricultural industry in order that it can maximize its potential.[17]

At the same time it remained unclear the degree to which Harrar's agricultural industry conflicted with any other

scientists' vision of productive agriculture. Was it not possible, after all, to organize agriculture which provided increased foodstuffs and expanded economic opportunities, and private profits? In the early 1960s, and with the establishment of CIMMYT in 1966, many international agricultural scientists supported this image of agricultural development. The separate division of wheat and maize, for example, reflected dual commitments in research. On one side, wheat scientists pursued what Borlaug termed "Yield blast off" or dramatic increases in production.[18] At the same time, in the maize program, Wellhausen and fellow scientists searched for means to initiate small, incremental increases in production. While wheat scientists worked primarily with a few wealthy agriculturalists, maize scientists emphasized projects targeted at the millions of small, non-commercial agriculturalists. CIMMYT appeared to pursue on a global scale what MAP had achieved on a national scale. As many development experts argued in the 1960s, their real task simply involved stimulating progress among the more backward parts of the countryside.

The question remained, did these separate research pursuits actually complement one another? Or were these exclusive projects, which contained latent conflicts? Did CIMMYT scientists, in 1966, constitute a single or dichotomous community? Had the Rockefeller Foundation helped to foster a science which benefitted "mankind"; or, did this science possess other social commitments? Part of the answer to these questions was contained in an assessment of the Mexican Agricultural Program. What was the measure of 'carry-overs' for Mexicans in general? In 1969 one of the first attempts to evaluate the consequences of MAP programs appeared in a publication authored by a former Rockefeller Foundation appointee and head of the economics unit, Donald K. Freebairn.

Freebairn's article, "The Dichotomy of Prosperity and Poverty in Mexican Agriculture," drew from his service with MAP from 1956 to 1960. Freebairn, while supporting the expansion of projects such as Puebla, attacked the wheat program's model of agricultural development. Freebairn, in a thinly veiled argument, suggested that the problems faced by millions of marginal farmers originated in misguided government policies. His study placed considerable importance on the fact that as many as 85 percent of Mexican agriculturalists (perhaps 20 million people) were "a very marginal item in the national agricultural economy; they did not constitute a significant market for the expanding consumer goods

industries";[19] that this situation resulted from historic public investment patterns: "Public investments largely in irrigation, agricultural credit, technical developments and their implementation, and the provision of production inputs, have been singularly concentrated in the hands of a limited number of farmers and into a fairly restricted geographic area." He added, "Attempts to modernize and reform established traditional agriculture have been almost nonexistent." [20]

As a solution, Freebairn called for a greater emphasis on research and assistance appropriate for millions of marginal agriculturalists. His proposal followed elements used in the wheat program, e.g., plant genetics, plant pathology, entomology, soil fertility, and so on. But how to have these developed for different ecological zones primarily used by maize cultivators? Freebairn additionally attacked the logic of the wheat program, while giving implicit support for maize scientists' work in the Puebla Project. He stated that, as with most underdeveloped nations, one will find "little of positive accomplishment" in the Mexican agricultural experience. A major premise for the rapid expansion of productivity, the so-called food crisis, represented what Freebairn termed a "simplistic" logic that did not reflect the situation faced by most countries. Freebairn concluded: "It cannot be expected that the experience with wheat will serve any useful purpose with respect to programs directed at a much wider number of smaller farmers." [21]

Freebairn's arguments anticipated the more vociferous attacks that were soon to appear in numerous articles by observers of CIMMYT-sponsored programs. These other observations, many appearing in the early 1970s, advanced the argument that agricultural techniques were biased in favor of wealthy farmers. Freebairn's article, at a minimum, called for greater understanding of social consequences by CIMMYT scientists.

Most readers, because of Freebairn's reference to the Mexican agricultural experience, missed the significance and more accurate object of his criticism: programs constructed by MAP and CIMMYT scientists. A clear implication of Freebairn's article was that dichotomy of prosperity and poverty in Mexican agriculture was a situation for which Foundation scientists held a direct responsibility. The very successes which MAP scientists explained as the basis for generating enormous increases in productivity, were used by Freebairn to explain why so few agriculturalists benefitted from

science-based agriculture. The control which the Foundation gradually exerted over extension work, agricultural experiment stations, agricultural colleges, seed production facilities, banks and lending agencies, and various portions of the ministry of agriculture were all directed to provide assistance to a small and select group of agriculturalists. For Freebairn, the very questions surrounding agricultural research were not simply technical, but political. He stated that these questions involved "land and liberty," "social welfare," and "equity and justice." [22]

From the perspective of the Ford and Rockefeller Foundations, Freebairn's remarks could not have appeared at a worse time. At the same time as the Foundations endeavored to gain a greater number of contributors to a permanent network of international agricultural research centers, criticisms threatened to destroy this effort. Freebairn's article did not go unnoticed by one of CIMMYT's most important donors, USAID. Within three months, Freebairn's publication provided the basis for a study by the USAID concerning the social and political aspects of new cereal varieties. The authors, J.T. French and P. Lyman, concurred with Freebairn's assessments of Mexican agriculture and cited his work extensively. "There is clearly a trend towards disparity in beneficial participation by farmers. This trend began in Mexico where new wheat varieties were developed and has been repeated to a greater or lesser extent in countries for which studies have been prepared." The two authors raised serious questions concerning USAID's contributions to a research network that perhaps fostered greater social inequities. [23]

In 1970 another CIMMYT donor, the United Nations Development Program (UNDP), helped to finance studies concerning the social implications of the new cereal varieties sponsored by the international agricultural research centers, including CIMMYT. Andrew Pearse headed these studies in the United Nations Research in Social Development (UNRISD) based at Geneva, Switzerland. [24] Soon after these studies began, Pearse traveled to Mexico and consulted with Luisa Pare concerning her observations of the Puebla Project. [25] Pearse later reported the importance of Pare's negative assessment of the project, particularly CIMMYT's treatment of participants as objects for increased production. The UNRISD, within three years, initiated country studies examining the new cereal varieties including a study authored by Cynthia Hewitt de Alcantara for Mexico. [26] Each of these studies repeated, in their particular way, the need to better

understand the social constraints and consequences surrounding innovations in agriculture.

In addition to the critical studies initiated by both a former employee and current donors, CIMMYT faced growing disputes among its scientists as well. While CIMMYT's work expanded internationally, scientists often advised governments on public policies (e.g., agricultural inputs, price supports and subsidies, etc.). Yet, as reflected in Freebairn's publication, scientists increasingly found themselves in disagreement. Maize scientists advocated measures to stimulate innovations among a greater number of small farmers. Wheat scientists urged governments to expand national production. The two approaches in maize and wheat, while potentially complementary, confronted one another in practice as adversaries.

Another focal point for disagreement among CIMMYT scientists appeared in the Puebla Project. For Wellhausen and Laird the project increasingly underscored the role of institutions and social organizations in agriculture. While maize scientists remained committed to technical assistance, they observed that the greatest obstacles to increased adoption were social, not simply technical, in nature. Reggie Laird and colleagues proposed that CIMMYT play a greater role in sponsoring programs that addressed the social problems surrounding agricultural production.

It was apparent to the Ford Foundation representatives that CIMMYT must address the social aspects of a production. Although Rockefeller Foundation officers resisted involving CIMMYT in such investigations, by 1971 CIMMYT established a section to study the economic aspects of agricultural production. Lowell Hardin, director for agricultural programs with the Ford Foundation who also served on CIMMYT's Board of Trustees, finally convinced other Trustees that without an economist, CIMMYT would be "vulnerable" to criticisms by outsiders. [27] The Board's sensitivity to its vulnerable position revealed a commitment to deterring, instead of thoroughly investigating, criticisms.

The decision to create a unit to deter criticisms was further reflected in the appointment of Donald Winkelmann as the head of economics. Although Donald Freebairn possessed excellent qualifications to conduct investigations and advise scientists, it appears unlikely that his candidacy was ever considered at CIMMYT. The whole purpose of economics did not include a serious examination of social consequences in science-based agriculture. Indeed, Winkelmann, a good

friend of Lowell Hardin, referred to his initial mission as "protecting CIMMYT from criticisms." [28]

One of Winkelmann's first studies for CIMMYT focused on the problem of farmers' low adoption rates of improved agricultural techniques. Although various studies and data existed for further examination, such as Pare's study of the Puebla Project, Winkelmann chose to look at different areas. Along with Richard K. Perrin, another economist named to the economics unit, Winkelmann began gathering data on different factors affecting farmer adoption rates. By 1976 Winkelmann and Perrin coauthored one of the economics unit's first major reports, Impediments to Technical Progress on Small Versus Large Farms (Impediments). [29] Impediments summarized maize adoption studies conducted at seven different sites around the world, including Mexico.

As indicated in the title, the purpose of Impediments was to examine the different effects that farm size had on the adoption of improved maize or wheat varieties and fertilizer. Their monograph concluded that the adoption rate for new seeds appeared to be at least weakly related to farm size. In the case of fertilizer use, the association was even stronger: "Space precludes a summary of the analyses of fertilizer adoption decisions, but there appeared to be significant size effects in fertilizer adoption in nearly half of the agro-climatic situations considered." [30] Yet, in spite of these findings, Impediments concluded that CIMMYT researchers needed to focus even more studies on biological factors limiting yields in specific ecological regions. The unconnectedness between findings and recommendations reaffirmed a basic commitment in CIMMYT economics--to avoid the study of social consequences in the spread of science-based agriculture.

As coauthor and contributor to Impediments, Richard Perrin prepared an individual investigation of farmers at Vera Cruz, Mexico. Perrin's report, "Maize Technology and Its Adoption in Vera Cruz, Mexico," was later remembered by CIMMYT staff as a lesson in how not to conduct social science research. Perrin set out to investigate what factors led certain farmers to adopt recommended practices, while other farmers retained their own methods. One of Perrin's first observations noted the extreme variability between farmers' plots and CIMMYT-managed field trials. Perrin reported that during the 1976 winter season, "neither the new Tuxpeno-1 variety nor nitrogen fertilizer (either alone or in combination) increased average yields when used

in conjunction with other cultural practices used by maize producers." [31] Perrin advised that CIMMYT scientists needed to better understand the impact of individual inputs on adoption instead of the packages constructed at experiment stations.

In addition, Perrin offered evidence that countered important assumptions at CIMMYT. Perrin noted in his study that there existed no evidence of a demonstration effect altering neighboring farmers, as was so often claimed by CIMMYT scientists. But even more important was a factor "cleansed" from the later Impediments report. Perrin stated that while enterprise size, as farm size in Impediments, related to adoption, "there was stronger evidence that farmers' risk perceptions and ability to undertake risk (as measured by wealth) explained some of the differences in farmers' decisions." [32] Perrin added to this the suggestion that, for even the farmers in his study, adoption rates were low in spite of access to credit.

Perrin's report undercut many assumptions held by CIMMYT scientists. One readily recognizable implication pointed to scientists' inadequate knowledge of farmers' practices. Perrin's report supported a view that farmers did not simply dismiss recommended practices on the basis of risk, but that the recommendations were unreliable. Perrin demonstrated that benefits frequently anticipated from experimental plots did not correspond to those conditions faced by many agriculturalists.

Various maize scientists recalled that many scientists, both in maize and wheat, were outraged by Perrin's report. Norman Borlaug, in particular, reportedly stated his dissatisfaction with the report and especially those details which cast doubt on the general applicability of field research. [33] Although CIMMYT provides no publicly accessible record, certain staff members claimed that Perrin's own departure in 1975 resulted from his report.

CIMMYT scientists left no doubt with Perrin regarding their reaction to his report, as he stated the impact he thought his paper had on CIMMYT:

I haven't attempted to publish the paper, in large part because of unfavorable reaction from CIMMYT, but partly because it is in need of further revision and I haven't wanted to spend time on it. I believe the study is a good one and that the message from it is clear. Despite the unfavorable

reaction from CIMMYT, I think they got the message, so perhaps the study has achieved much of what it might.[34]

As much as five years later, however, reaction to his study took a form quite different from what he hoped. Economists who replaced Perrin assiduously avoided informing scientists about the failings of their work in the social context. Indeed, during on-farm trials conducted at Vera Cruz in 1980, this author observed maize scientists selecting experimental sites in a manner that disregarded Perrin's advice. Maize scientists (in order to attain impressive results as a demonstration to neighboring farmers) avoided terrains that characterized many of farmers' fields: steep hills, fields without proper drainage, locations far from input access points, very small plots, or situations that demanded intercropping.[35] One economist, when asked what he remembered of Perrin's report responded, "Perrin's mistake is that he asked the wrong questions." [36]

How did CIMMYT economists decide between 'right' and 'wrong' questions? According to Freebairn, the correct questions to pursue were those which dealt with the failures of a research to make significant and rapid contributions to the welfare of mankind. He suggested that topics such as agrarian reform represented a legitimate inquiry for economists. Perrin too offered support for the idea that economists had to look at relationships beyond expenditures and revenues. But how were these economic perspectives to be reconciled with Winkelmann's approach (which, to repeat, made a careful separation between those social elements of economic life that influenced the spread of CIMMYT technologies and other aspects of social life) when it was precisely this separation which Freebairn, Perrin, and others argued to be artificial and misleading? These economists essentially challenged Winkelmann to demonstrate how aspects of economic life could be separated from other facets of society. The distinction between the economics pursued by Perrin or Freebairn and those pursued by Winkelmann highlighted debates as to what concerns CIMMYT economics should be based on. Particularly those studies conducted by the UNRISD suggested that the most important criteria for measuring the performance of the new cereal technologies had to be understood in much more expansive terms including nutrition, tenancy, and social relations.

Resolution of these different approaches to economics did not, however, include a comprehensive discussion of

these perspectives. Nor does it appear that the determination of appropriate economic studies emerged from a community move from one paradigm to another. Rather, economic thought at CIMMYT emerged from that interpretation which best corresponded to the dominant thought community: the agricultural scientists. Rather than economists influencing agricultural scientists, it was agricultural scientists who influenced the selection of economic thought that best matched their own goals. While this selection of social inquiry appeared to be patterned after natural science, such explanation only disguised the commitments present in the scientific community of CIMMYT. The basis for rejecting other economic paradigms derived, therefore, not from a freedom of discussion but a constrained and restricted community. When I asked Winkelmann to explain why he did not consider the UNRISD studies important, he declared, "I am not interested in theories of how the rich screw the poor." [37] This statement represented his own thought; it also reflected a conclusion reached by CIMMYT agricultural scientists generally. The rejection of ideas advanced by Freebairn and Perrin followed a pattern set earlier with the dismissal of proposals by Sauer and Holmberg. Over time, this rejection occurred not simply from decisions imposed by Harrar, or even the Rockefeller Foundation, but carried out by the community of international agricultural scientists.

In the late 1960s CIMMYT faced a problem in addition to that posed by outsiders' criticisms. This other problem appeared with CIMMYT's involvement in the Puebla Project. The project confronted CIMMYT scientists with the dilemma of constructing a rural development project that frustrated their attempts to achieve widespread improvements among small scale agriculturalists. The culmination of controversies generated by the Puebla Project was not the expansion of the research mission, but the reverse. Scientists, such as Laird and Wellhausen, who had played an intimate role in designing Mexican agricultural institutions, were now stymied in later efforts to reform these bureaucracies.

The reforms that Laird and Wellhausen pursued, to make their own cadre of Mexican trainees more responsive to goals beyond mere productivity, contradicted MAP achievements in Mexico. U.S. agricultural scientists succeeded in replacing decision making based on explicit political commitments with professional standards based on agricultural science. This was particularly the source of antagonism between the Office of Special Studies (OSS) and the Institute for Agricultural Investigations (INIA). The creation of INIA in 1960 marked

the OSS's success over IIA and the domination of rules governed by the MAP's notion of agricultural science. When Laird and Wellhausen attempted, in the 1960s, to reform agriculture, they were confronted with the intractable science which they had helped to create.

At the same time, ideas presented by Laird and Wellhausen for the reform of agricultural research received hostile reaction from CIMMYT scientists. Particularly wheat scientists viewed the Puebla Project as having confused the goals of productivity with those of social welfare. Whereas various maize scientists involved in the Puebla Project presented these two goals as complementary, many other scientists viewed their responsibility for social welfare as limited to increases in production. If these goals were indeed contradictory, wheat scientists responded (as did Winkelmann) that this was someone else's problem.

During the early 1970s the direction of research changed noticeably at CIMMYT. While the mission had always given primacy to the place of agribusiness and corporate agriculture, it now reconsolidated this orientation by eschewing commitments to other agriculturalists. The scientists argued against investigations directed at impoverished agriculturalists as inhibiting the return to basic scientific research. The outcome of this apparent 'return to science' provided a more well-defined link between the production of science and capital.

One of the first signs of this return to basic research came with the departure of John Lonnquist who had directed CIMMYT's maize program since 1966. In 1970 Lonnquist returned to teaching at the University of Wisconsin after a death in his immediate family.[38] In the late 1960s, scientists in both the maize and wheat programs had complained about Lonnquist and sought to have him replaced. The basis for objecting to Lonnquist most frequently mentioned referred to his 'academic' style.[39] Certain CIMMYT scientists explained that the problem in this style meant that a number of kinds of studies were acceptable to Lonnquist. While the basis for objections alleged that maize research under Lonnquist had dubious relations to practical problems, the maize unit's largest research effort at this time was the Puebla Project. According to certain scientists, such as Laird and Wellhausen, Lonnquist's encouragement of the Puebla Project produced some of the first really basic and practical research at CIMMYT.

In 1970 Ernest Sprague replaced Lonnquist as director of the maize program. One scientist reported that Sprague's main qualification for the position had to do with his affiliation with the Ford Foundation and the demand that one of 'their' people occupy a leadership position at CIMMYT.[40] But Sprague had other qualifications as well. In Asia Sprague's approach to maize production emphasized the spread of technologies with few of the socioeconomic concerns that accompanied the Puebla Project. Laird proposed a larger role for CIMMYT in guiding institutional policies as a means of engaging a larger number of farmers. Sprague worked to achieve somewhat different ends. For Sprague the goals of the maize program were to dovetail with those of the wheat program: to increase aggregate levels of national production irrespective of how many farmers this included, or of the consequences beyond production.

In 1971 Wellhausen suffered a heart attack and had to retire from his position as CIMMYT's director general. The Ford Foundation offered another of its officers, Haldore Hanson, as a replacement for Wellhausen. Hanson, while possessing experiences in the management of rural development projects in Asia and Africa since the 1960s, held no formal training in the agricultural sciences.[41] Hanson, nevertheless, did bring CIMMYT a new regime that reflects much of its current organizational practice. In sharp contrast to Wellhausen's administration, Hanson kept discussions confined to technical matters and basic research. Various scientists recalled that attempts to address issues beyond technical aspects of research were actively curtailed in both formal and informal settings. This was especially the case in discussions that had been sparked by the Puebla Project. Indeed, Hanson and Sprague urged that CIMMYT reaffirm its 'scientific' character by terminating support for the Puebla Project. Although the project at Puebla continued to attract donor support and was expanded to other sites in Latin America, scientists including Sprague and Borlaug advocated to end CIMMYT's involvement. Winkelmann and Hanson concurred with this judgment, while certain maize scientists such as Laird, objected and called for CIMMYT's continuation. Hanson called for a review by the Board of Trustees and an outside panel of 'experts.' By the close of 1972 CIMMYT announced no further support would be given to the Puebla Project.

By 1973 Reggie Laird, among the last members of the original mission, departed CIMMYT to teach courses in agricultural science at Chapingo. Although still very active in

teaching and research in 1980, Laird held no position at CIMMYT, only a few kilometers away, and only visited infrequently. Wellhausen, who made a rapid and full recovery, never again resumed a position of authority at CIMMYT. While he makes frequent trips throughout the world, Wellhausen seldom, if ever, makes the one hour trip from his Mexico City residence to CIMMYT.

With the change in the composition of the scientific community, the conceptions surrounding the perception and discussion of agriculture also changed. By the early 1970s both the maize and wheat programs pursued similar objectives--the transformation of agricultural production. In a 1966 article Borlaug outlined the elements used to improve agriculture. "Basic Concepts Which Influence the Choice of Methods for use in Breeding for Disease Resistance in Cross-Pollinated Crop Plants" (hereafter referred to as "Basic Concepts") explained that, "The basic principles underlying plant breeding programs are the same, regardless of species." Borlaug listed five fundamental considerations:

- 1) What are the principal diseases that limit the productivity of the species which is to be improved?
- 2) What techniques or methods are best for identifying the gene or genes for resistance to the principal disease of the crop (species) under consideration?
- 3) How can the genes for resistance to a specific disease be incorporated into the commercial parental variety without simultaneously introducing adverse effects on such characters as yield, rate of growth, agronomic type or forest type, and product quality?
- 4) How can the specific disease resistance genes be incorporated into commercial parental variety without simultaneously incorporating increased susceptibility to some other disease or insect pest that was previously only of minor importance?
- 5) How can the desired disease resistance be incorporated into a new variety so that once attained, it will be maintained in a useful form for a long period of time?[42]

What emerges from "Basic Concepts" is not simply a procedure for conducting investigations in agriculture, but a suggestion of their link to only certain elements of the social context. Under heading numbers 3 and 4, for example,

Borlaug notes the importance of diminishing disease in terms of its commercial value. This objective is evidenced in meetings of CIMMYT, where economists and maize and wheat breeders discuss the monetary value of creating plant materials for different ecological zones. In these discussions, breeders typically begin with zones where maximum yields are most easily obtained. Negotiations focus on designing plants for areas where commercial success is less certain.

The objectives of the maize program, since 1971, largely correspond to a research mission patterned after the wheat program. The program now appears to have a reduced focus, constructed around the objective of producing germ plasm. In a 1979 CIMMYT report we find a language used to characterize this project:

The basic procedure for achieving order adaptation in CIMMYT maize populations is the selection of the superior genotypes under a series of different environments, followed by their successive recombination through an indefinite number of such selection cycles. In all such materials, the aim is to include all possible appropriate germ plasm in the formation of the base population. In most cases, germ plasm is assembled from areas representing the extremes of the range of conditions for which the population is being developed. Then, after cycles of mixing, selection is done under different environmental conditions.[43]

This procedure, while possessing a universalistic image is, in fact, quite narrowly focused. In the preface to this report we encounter a slightly more revealing definition of the environmental boundaries:

CIMMYT's efforts in maize improvement are directed toward the development and maintenance of broad-based gene pools and populations. Toward this end we have designed and implemented a continuous improvement system in which a wide range of materials to serve the major maize-producing areas of the developing world are assembled into gene pools, which in turn are improved to the point that they are genetically ready to contribute superior and new germ plasm to more advanced populations to meet specific production objectives.[44] (Emphasis added)

CIMMYT mentioned, among those interested and participating in research, major seed producing companies include Pfitzer, Pioneer Hybrid, Northrup King, and DeKalb.

The "Basic Concepts" in wheat and "basic procedure" in maize constitute a common basis for improving agriculture. In contrast to previous disagreements among scientists in the 1960s, there now exist "basics" that form the basis for a scientific community at CIMMYT. The community is once more bounded by a cohesive body of thought and single-minded purpose. Norman Borlaug refers to this as a "team approach." The community defines itself as sharing a common commitment to improving agriculture through science. Even though CIMMYT's basics are linked to economic considerations, scientists portray these as part of a larger project--to feed the world. Hence these economic considerations appear justified. At the same time, CIMMYT scientists repeat that their work remains rooted in the natural sciences in a way that does not allow them to promote special interests. Take, for example, a statement delivered by one of CIMMYT's foremost spokespersons, Norman Borlaug:

Often these individuals [critics of CIMMYT] seem to be the same utopians that criticize plant breeders for having been unable to produce a variety of grain that will grow well and produce 8 ton/hectare grain yields on small farms, but yield only 2 tons/hectare when grown with the same technology on large farms. Unfortunately, this has been unachievable up to now because plant varieties are both apolitical and impersonal.[45]

Yet Borlaug, at the same time, speaks of his mission as directed toward solving world hunger. It was the work performed by CIMMYT wheat geneticists in the creation of the Mexican agricultural 'miracle' that earned Borlaug the Noble Peace Prize in 1970. The humanitarian basis for CIMMYT's investigations is evinced in another of Borlaug's statements:

... unless food production and population growth are both recognized as part of the same problem and attacked aggressively, without emotion or rhetoric, the Green Revolution, like all previous green revolutions, will fail to bring a decent standard of living to the developing nations, and in the process constitute a basis for establishing

and hopefully maintaining a stable world order.[46]

Borlaug's statements are not novel. They repeat doctrines for peace and productivity that Stakman, Bradfield, Mangelsdorf, and Harrar voiced in the 1950s. The basic premise is still the same: "a well fed world is a peaceful world."

If CIMMYT could claim to having ended hunger and malnutrition in the world, the assumption that its work in science serves mankind's welfare might be accepted as fact. But its contributions in this regard are suspect. It is not the purpose of this book to summarize the extensive literature which denies CIMMYT's contributions to humankind. The issue is how CIMMYT, as a community of scientists, has responded to criticisms such as those prepared by the UNRISD. In this regard CIMMYT scientists quite simply refuse to understand the consequences of their work to be other than that which they claim (i.e., to benefit society).

More alarming still is the record marginalizing those members of the community who contest CIMMYT's research orientation. Since the initiation of the Foundation's mission in 1943, there is a demonstrated pattern by which those who raise questions about relations between science and society have been excluded from participation. This list includes: Carl Sauer, Edgar Anderson, Edmundo Taboada, Flores Munoz, and Allan Holmberg. There is also the list of those excluded from within the Foundation, that extends from MAP to CIMMYT, from the International Health Division surveys to William Myers, Donald Freebairn, Richard Perrin, Reggie Laird, and Edwin Wellhausen. The exclusion of the last several members of the Foundation is particularly alarming with respect to their attempts to challenge assumptions in science. This challenge contests exactly those aspects of Borlaug's remarks which locate problems in Mexico and elsewhere as produced by political instability, traditional agricultural techniques, and population growth. Especially, Donald Freebairn and Edwin Wellhausen argued that these three elements were only partially, if even that, responsible for conditions of underdevelopment. Each of these observers suggested that perhaps the most important element absent from Borlaug's analysis was the role of dominant class interests. Another observer, Carl Sauer, advanced the idea that the concentration of economic power within a single class was the basis for the problem in Mexico and Latin America.

Integral to the basic concepts that operate in CIMMYT research is the dismissal of economic and political power as representing a problem in need of solution. At the same time, CIMMYT scientists do not remain passive or indifferent to the political and economic aspects of society in their research. Research priorities, as illustrated in basics in wheat and maize programs, are developed as analogous to a "free market" that has but a few producers. This orientation is reflected in a recent document authored by CIMMYT's trustees discussing how to establish research priorities:

The business world sets its priorities after research of the market potential. This means they study consumer acceptance of the product, the supply of raw materials, and the environment for the product, whether political, or economic or biological. After these studies, a company decides whether to build a new factory, or increase the capacity of existing facilities, or to reduce or shut down its operations.[47]

Agricultural research sets its priorities in much the same way. This equating of research priorities with the business world creates a basis for irresponsibility in science like that of corporations. Techniques are considered in terms of political and economic interests. Reflections on the social consequences of science-based agriculture, so often assumed to be within the conduct of scientific inquiry, are nowhere given concern. As a result, the language of research combines only those social aspects that have meaning for economic and political interests: major producing regions, commercial varieties, food production, agricultural industries, and so on. While these terms hold potential significance for other social classes, CIMMYT investigators never construct and always eschew measures necessary to convert potential benefits into actual ones.

The distinction between factors of production and social consequences, in addition to its professional commitments and language, is encouraged by international donors. Observe the description offered by a scientist who worked with both MAP and CIMMYT, regarding recent trends in CIMMYT's research.

Question: What about debate on these issues [research priorities]?

Response: Debate is not permitted. . . Much of what is done at CIMMYT is determined by how much money you can get. But the money that is available is not with respect to what is urgently needed in agriculture. Often the Foundations come with an idea of what are their problems.

Question: But don't you meet with donors and talk over what were needed areas of research?

Response: You don't talk to the donors that way or you might get fired. No one has ever done that. And the donors don't do that or they will not be invited back. The donors come for a show and to be winned and dined. The Canadian group [International Development Research Centre] came and requested that we spend our funds more rapidly on the Andean project, otherwise they would not be able to give us more money in the future. The AID [U.S. Agency for International Development] folks dream up projects with which to spend their funds. The World Bank recently created an irrigation project in Sinoloa in order to infuse money into the Mexican economy.[48]

The relationships that have grown between CIMMYT scientists and international agencies are mutually reinforcing. The donors actively contribute to a network of research centers that promise to solve social problems by means of a science that promotes economic development. Scientists are further encouraged that their work makes genuine social contributions through basic research. Yet, both sides operate in a context where criticism and debate are suspended. When, on occasion such as the Puebla Project, both donors and scientists are confronted with evidence that denies the social value of their project, discussion is further limited. New projects, techniques, and research are proposed without benefit of analyzing history from others' perspectives and scientific inquiry becomes an efficient disguise for political and economic dogma.

CHAPTER VIII--NOTES

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Politicized Science

A dominant tenet of the Rockefeller Foundation's work in agriculture, as well as medicine, was the proposition that social problems could be solved by extending human control over physical, production processes. When the Rockefeller Institute, for example, posed questions about health in relation to productive aspects of medicine, problem-solving relied on the production of a greater number of doctors, hospitals, and techniques for the control of physical relations between disease entities, principally germs, and the human body. The consequences that resulted from setting such perspectives in motion extended well beyond the public's health. The Foundation's perspective established numerous social consequences including institutionalizing the definition of legitimate methods for controlling diseases.

The scientific perspective adopted by the Institute was also reflected in the agricultural sciences where the Foundation identified landscapes in terms of their productive capacities. Farm demonstrations constituted a scientific perspective where "the food problem" became located in farmers' fields. Rockefeller Foundation managers of science recruited and encouraged other scientists to participate in the management of agriculture on the basis of their willingness to operate within a restrictive investigation of agriculture.

The resulting 'production paradigm' reflected a liberal economic belief that adjustments in production could provide the basis for a progressive social order. The 'problem' identified by the Rockefeller Foundation scientists was premised on the notion that agricultural lands were not sufficiently productive to promote economic growth.

In various scientific pursuits, the Rockefeller Foundation regularly referred to its commitment to serve the welfare of mankind. The Foundation offered production as the solution to social problems while at the same time defeating contending paradigms. Foremost among contenders was a problem-solving perspective that examines social relations or the social relations paradigm.

Advocates of the social relations paradigm argued for scientific inquiries addressing the problem of unequal political power. This inquiry served as the foundation for analyzing problems including hunger, agricultural production, and economic development. The perspective that social relations, not individual actions, represent the foundation for analyzing social problems also suggests changing public institutions, class relations, and the control of productive resources. The solutions offered by U.S. agricultural scientists for problems in agricultural production necessarily displaced the primacy of political relations so long advocated by Mexico's traditional agricultural experts.

To simply describe the differences between these two paradigms as one of science versus non-science is to not comprehend the common role that social and political thought have played in the development of research institutions, professional communities, and scientific inquiry.

The debates between these two approaches reoccurred throughout the Foundation's history reflecting a pattern of development among scientific communities. Consider the Rockefeller Foundation's early contributions to science. The support provided to certain medical researchers and others, J. Loeb and J. Griscom for instance, often hinged on an examination of productive factors, but excluding social relations. Loeb's mechanistic view of nature perceived only relationships that operated within the individual's body as causal of disease. Griscom, in contrast, drew attention to not simply biological factors within the human, but relationships between the body and the social order as the basis for health.

The difference between problem-solving based on the production versus the social relations paradigm is illustrated again in the case of E.V. McCollum. The investigations conducted by scientists at the Johns Hopkins School for Public Health analyzed health from the perspective of production characteristics of the body. McCollum upon his arrival at Hopkins questioned the production of nutrients as

sufficient to answer what he regarded as the foremost problem. In place of examining micro-nutrients and their role for the individual body, McCollum proposed an investigation of nutrition based on relations between methods of production and human health.

The failures of Griscom and McCollum, in retrospect, do not appear as isolated examples. During its first several decades this pattern of commitments was reinforced within various scientific communities by the Rockefeller Foundation. This pattern reflected an advocacy of the production paradigm predicated on the elimination of other modes of investigation, such as the social relations paradigm. The obliteration of the social relations paradigm and the domination of the production paradigm was probably nowhere as striking as with the evolution of international agricultural research.

Disagreements regarding the production-oriented approach advocated by the Rockefeller Foundation in agricultural research also appeared during the initiation of the Mexican Agricultural Program. One of the first of these disputes appeared with the identification of 'the problem' in Mexican agriculture according to research conventions of U.S. land grant colleges. The Rockefeller Foundation, by asking three leaders in U.S. agricultural research to assess Mexico's agriculture assured a recommendation that would reaffirm production-oriented research as a basis for solving social disorders. None of the three agricultural scientists asked by the Foundation to consider the problem in agriculture possessed any particular knowledge about Mexico or ways of analyzing production with relation to political power, public institutions, or historic social struggles.

Perhaps the only person available to the Foundation able to address these relationships, Dr. Carl Sauer, offered a fundamental critique of the production-based plan for Mexican agriculture. Sauer, while agreeing that productivity represented a part of the problem, directed attention to the social factors he believed to account for poverty. The Foundation's plan was further contested with the work Sauer did with Anderson. Their work revealed a fundamental schism as to whether production should be seen from the perspective of those who worked the fields or those who controlled productive resources.

The question of control over production appeared as a central point of contention between Mexico's indigenous scientists and those imported by the Rockefeller Foundation

from the United States. At the heart of disagreements between the Foundation's scientists working in the Office of Special Studies and the community of Mexican nationals working with the Institute for Agricultural Investigations was a fundamental question: "Whose production?"

U.S. scientists subscribed to a notion that their investigations could be separated from the politically powerful to serve all humankind. Mexican researchers argued that unless the politically powerless controlled the direction of scientific investigations, results would bypass the powerless. The eventual success of U.S. agricultural scientists in Mexico pursuing a production paradigm was not, however, based on the triumph of reason; rather, it was founded on its relationship to politically powerful forces in the United States and Mexico. The Foundation's claim of service to humankind proceeded via a process of inquiry that rejected competing knowledge claims. The fact that the production paradigm received assistance from the politically powerful classes in the United States and Mexico contradicts the Foundation's tenet that one science is necessarily a service to the welfare of humankind.

In the 1940s and early 1950s the proposals for increased production advanced by George Harrar confronted opposition from first Edmundo Taboada and later Flores Munoz. Whereas Harrar constructed projects to maximize production, Taboada and Munoz fought unsuccessfully to include other considerations (e.g., both popular demands for agrarian reform and private political ends) in the production-as-problem approach advanced by MAP scientists.

Distinctive problem-solving approaches concerning the social consequences of agricultural innovations occurred as still another contest. One group, comprised of John Dickey, Herrell DeGraff, Kenneth Turk, and Chester Barnard, opposed another collective, including William Myers, Allan Holmberg, and Donald Freebairn, about whether science-based techniques were sufficient to solve the 'problem' in agriculture. The division of scientists into separate camps grew sharper over time, especially with the advent of the Puebla Project. While Reggie Laird and Richard Perrin presented evidence arguing for the expansion of problem-solving approaches to include institutional and social factors, Donald Winkelmann and Haldore Hanson fostered a research climate that eliminated these arguments. The dispute about where to locate problems in agriculture (i.e., the production or social relations paradigm) culminated with the questions that

scientists in the wheat and maize programs began to raise with respect to the value of one another's research.

A central criteria for becoming a member at MAP and CIMMYT depended on being a "team member" who would be compatible with others' work. The recounting of disputes within CIMMYT's scientific community gives the impression that regular and vigorous debate occurred among scientists advocating different problem-solving methods. The most striking feature of the community of international agricultural researchers supported by the Rockefeller Foundation, however, is the constraint that has surrounded scientific discourse and practice.

The characteristics of inquiry at MAP and CIMMYT bear little, if any, relation to the popular images of scientific discourse--impartiality, objectivity, and the absence of politics. The resolution of differences both among CIMMYT scientists themselves and with others outside of their community has instead been marked by the absence of thoughtful discussion and open inquiry. The continued focus on a single problem-solving format, the production paradigm, has been based on the active and authoritative exclusion of competing approaches.

Indeed, the Foundation's most significant achievement in science has been the reproduction of particular styles of thought in the empowerment of scientific communities such as CIMMYT. The preference of science-based institutions over popular means for identifying problems in agricultural production (e.g., Mexican practical schools of the 1930s) has been based on the presumption that a larger and more enduring public good is served by scientific communities such as CIMMYT. More than just the production of crops, CIMMYT scientists have succeeded in defining (and altering) relationships between laborers and the land they work, the hungry masses and their right to secure food, and the knowledge necessary for making decisions in the public interest. It is particularly with respect to this last mentioned relationship, between science and the public interest, that a primary function of international agricultural research is revealed--the political dimensions of science.

In the late twentieth century, international agricultural research centers simultaneously promote and suppress certain kinds of knowledge. We now possess increasingly detailed and specific information about relationships between plants, soil, and the physical dimensions of production.

At the same time we understand little about what physical changes in plant production mean for society. The consequences of replacing traditional varieties with genetically engineered crops for human nutrition, employment, and social relations appear to be increasingly less understood by scientists who have engineered these changes.

While scientific inquiry is classically understood as the basis for greater knowledge, it can also provide the foundation for eliminating competing kinds of knowledge. One author, Ludwig Fleck, has described a primary characteristic of scientific thought organized by communities of scientists as 'thought constraint.' For Fleck, and indeed various other observers, a less well understood social function of science is the obliteration of other kinds of knowledge.

Perhaps the most remarkable aspect of this critical perspective of science is the revelation of political authority that operates within modern scientific communities. The basis for political authority exercised by communities such as CIMMYT involves the identification of the knowledge necessary for the exercise of authority in political institutions. The authority exercised by international agricultural scientists is predicated on the destruction of knowledge as much as a production of techniques. The significance of communities such as those founded by the Rockefeller Foundation can be best understood by what Ludwig Fleck referred to so long ago as "determining what can be thought in no other way."

A historic view of the achievements of international agricultural scientists, in addition to replacing one crop variety with another, must also include the replacement of one kind of knowledge about agriculture with another one. A marked tendency in the twentieth century is to accept this new knowledge, science as we have come to understand it, as an improvement over earlier styles of thought.

The seeming progression of science-based knowledge is predicated on internal criteria for validation. Terms establishing more precise and detailed relationships between plants, soils, climate and their micro-constituents define the boundaries of progress. Inquiry which explores the relationships between human settlements, social movements, the nature of work, and changes in agriculture become increasingly distant to this unidimensional science. Such considerations are gradually reduced to peripheral status where quasi-scientists (e.g., political scientists) discuss the role of ethics and a more humane science. Efforts to achieve

interdisciplinary inquiries, such as between the social and biological sciences, continuously fail to examine the social and political foundations of such projects. Missing from these analyses of science is an understanding of the values already perpetuated by the organization and practice of science.

One of the most significant steps in the establishment of international agricultural research occurred with the institutionalization of U.S. scientific thought in Mexico during the 1940s. It was particularly at this juncture that U.S. scientists struggled to establish the authority of their scientific thought. It was also at this juncture, following the aftermath of continuing agrarian struggles, that a knowledge about the social dimensions of productive relations was subordinated to inquiries directed at plant production.

The struggle to establish one style of thought, the production paradigm, in place of another, the social relations paradigm, was not resolved by neutral, objective, or impartial discussions. Rather, very distinct and usually opposed social interests combated to establish one thought style over another. In these struggles, institutions, such as CIMMYT or the graduate school at Chapingo, have monopolized scientific thought as a basis for defeating opponents. Moreover, the arena in which these struggles took place, science-based institutions were directed at a most critical topic: the organization of production. The historic outcome of agrarian struggles which occurred during past decades in Mexico was the flourishing of inquiries linked to political goals. At the same time that these institutions have generated an intensive knowledge about plant production techniques they simultaneously fostered an ignorance of society and its relation to changes in the organization of production. As a consequence of their own inquiries, the ability of researchers at the international centers such as CIMMYT to understand the social consequences of their work has become increasingly fragmented over time.

Various policies adopted by scientific communities, such as the International Rice Research Institute's interest in fostering the widespread adoption of novel production practices, are concerned only with society as it relates to the goal of increased production. The condition of the international centers' work on plant production, while relating to the human factors of production, remains disconnected

from other vital questions including whether or not increased production has a consequences for those people who are most in need. Why is more food being produced if more of the world's hungry are not being fed?

Comprehending the International Maize and Wheat Improvement Center's history cannot be achieved by looking solely to the role of any one scientist, such as Norman Borlaug, or a single scientific claim. While the contributions by individual scientists to CIMMYT may be noteworthy, the role of those who were not allowed to participate is probably more significant. The place of Carl Sauer, for example, may have provided a redirection of thought having no less profound consequences for the world's poor. The importance of these two persons, however, must be understood in the larger context of a process whereby one type of thought receives encouragement and recognition as 'science' while other styles of thought are neglected and regarded as 'non-science.'

The political dimensions of science are of a more subtle and enduring quality than simply the tangible effects of technology. The effects of science extend to the construction thought styles based on scientific practice which have political significance. The relationships described by science have meaning not only for physical bodies, but social and political ones as well.

Perhaps the most significant consequence of the rise and spread of international agricultural research, therefore, is with respect to the production of knowledge, not plants. The dramatic transformation that occurred in Mexican agriculture following the establishment of the MAP, and later CIMMYT, moved well beyond farmers' fields to include public institutions. The Rockefeller Foundation's success in patterning agricultural colleges, research stations, and national bureaucracies according to a U.S. model, signaled the gradual demise of struggles regarding the distribution and control of land, water, and capital. A debate that began at the turn of the century over the political control of resources became altered in the 1940s with a discussion of what techniques to employ in agricultural production practices. The scientific practices, institutions, and professions fostered by U.S. agricultural scientists effectively displaced the legitimacy of political demands challenging the class control of resources.

Within a generation, concepts such as breeding, germ plasm, and disease resistance were employed to the exclusion

of social analysis of the political control of resources, including the production of knowledge about how to foster technical solutions to social problems without altering political relationships. Scientists and their professional communities became effective political tools to compromise demands for changes in political and social relations. Yet scientists worked within institutional settings and professional communities in which they exerted little control.

A fundamental dimension of professional communities and scientific institutions is their use in eliminating political discourse. The process of eliminating, and not simply substitution, is fostered by the increased status necessary to participate in decisions--a process that restricts the legitimacy of public discussion. The history of CIMMYT reveals the difficulty that participants to the process--scientists--face in attempting to discuss the legitimacy of different problems and the ability to identify problems.

The fact that communities of scientists are founded on styles of thought places an enormous burden of proof on the individual who attempts to question the direction of an institution such as CIMMYT. In the history of CIMMYT, individuals who remained in conflict with institutional goals either left or were expelled from not only the institution but to some degree from the agricultural sciences generally. This defeat of the individual resulted in large part because of the failure of individual scientists to accept their expulsion--instead of questioning the social foundations of inquiry and practice in science. This situation, of course, is one which continues to confront numerous scientists in many fields today. The lesson is clear that unless members of any professional community are willing to analyze the dilemma of a mal-practiced science in terms of specific social forces which shape their thought styles, their struggles will necessarily be a solitary one.

Acronyms and Abbreviations

ANAGSA	Agricultural Insurance Agency
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo International Maize and Wheat Improvement Center
DNSA	Division of Natural Science & Agriculture, Rockefeller Foundation
DNS	Division of Natural Science, Rockefeller Foundation
DSS	Division of Social Science, Rockefeller Foundation
FAO	Food & Agriculture Organization, United Nations
GEB	General Education Board, Rockefeller Foundation
IBRD	International Bank for Reconstruction & Development, United Nations
ICWRI	International Corn & Wheat Research Institute
IHC	International Health Commission, Rockefeller Foundation
IHD	International Health Division, Rockefeller Foundation
IIA	Instituto de Investigaciones Agricolas Institute for Agricultural Investigations

INIA	Instituto Nacional de Investigaciones Agricolas National Institute for Agricultural Investiga- tions
IRRI	International Rice Research Institute
MAP	Mexican Agricultural Program
OEE	Oficina de Estudios Especiales Office of Special Studies
OSS	Office of Special Studies
PRONASE	Productora Nacional de Semillas National Seed Production Agency
RF	Rockefeller Foundation
UGOCM	Union General de Obreros y Campesinos de Mexico General Union of Mexican Workers and Peasants
UNDP	United Nations Development Program
UNRISD	United Nations Research Institute for Social Development
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

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